02-8403-109A-SI

FINAL DRAFT
SITE INSPECTION REPORT
AND HAZARDOUS RANKING SYSTEM MODEL
LAKEWOOD TOWNSHIP LANDFILL
LAKEWOOD, NEW JERSEY

PREPARED UNDER

TECHNICAL DIRECTIVE DOCUMENT NO. 02-8403-109A
CONTRACT NO. 68-01-6699

FOR THE

ENVIRONMENTAL SERVICES DIVISION
U.S. ENVIRONMENTAL PROTECTION AGENCY

AUGUST 8, 1986

NUS CORPORATION
SUPERFUND DIVISION

SUBMITTED BY

DANIEL CARAMAGNO
PROJECT MANAGER

REVIEWED/APPROVED BY

RONALD M. NAMAN
REGIONAL PROJECT MANAGER

235870

NUS CORPORATION
RARITAN PLAZA III
KING GEORGE ROAD
EDISON, NEW JERSEY 08837
(201) 225-6160

C-584-07-86-76

July 21, 1986

Ms. Diana Messina
U.S Environmental Protection Agency
Region II
Edison, New Jersey 08817

Dear Diana:

Enclosed are the Site Inspection Report (EPA Form 2070-13) and the MITRE Hazard Ranking System (HRS) documents for Lakewood Township Landfill, Lakewood, New Jersey. The site inspection was authorized under TDD #02-8403-109A.

Very truly yours,

Daniel Caramagno

Reviewed and Approved: J. B Taylor

DC/jm

Enclosures

SECTION 1

SITE INSPECTION REPORT EXECUTIVE SUMMARY

NUS CORPORATION
A Halliburton Company

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
EXECUTIVE SUMMARY

Lakewood Township Landfill	NJD980529358
Site Name	**EPA Site ID Number**
New Hampshire Avenue Lakewood, New Jersey	02-8403-109A
Address	**TDD Number**

SITE DESCRIPTION

The Lakewood Township Landfill was a municipal landfill that was in operation from 1955 to 1968. This landfill occupies 60 acres in an industrial park southeast of the center of the Town of Lakewood. An active composting operation is currently on site. The site was investigated as a result of unconfirmed claims of chemical drum disposal.

To the west of the landfill are several private homes, some of which own private wells. Water testing by county health officials in 1981 found no contamination except for one well containing 1,1,1-trichloroethane. This well is an isolated case, however, with no evidence that attributes contamination to the site. Three quarters of a mile north of the site is an 80' deep municipal well. Beyond one mile are several other municipal wells but they are 600 or more feet deep. On site are several surface water streams which flow east to Barneget Bay. This water is used for recreation a little over three miles downstream.

On August 29, 1984 a site inspection was conducted at the Lakewood Township Landfill. Two groundwater, two sediments, two surface water and two soil samples were collected from the facility. Analysis of these samples found carbon disulfide, iron and lead on the site none of these substances can be attributed to on site hazardous waste activity.

HAZARD RANKING SCORE: $S_M = 1.48$ ($S_{gw} = 2.56$ $S_{sw} = 0.17$ $S_a = 0$)
S_{FE} = Not Scored
$S_{DC} = 0$

Prepared by: Daniel Caramagno **Date:** 7/18/86
of NUS Corporation

SECTION 2

ENVIRONMENTAL PROTECTION AGENCY FORM 2070-13

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 1 - SITE LOCATION AND INSPECTION INFORMATION

1. IDENTIFICATION
01 STATE 02 SITE NUMBER
NJ D980529358

II. SITE NAME AND LOCATION

01 SITE NAME (Legal, common, or descriptive name of site)
Lakewood Township Landfill

02 STREET, ROUTE NO., OR SPECIFIC LOCATION IDENTIFIER
New Hampshire Avenue

03 CITY
Lakewood

04 STATE: NJ
05 ZIP CODE: 08701
06 COUNTY: Ocean
07 COUNTY CODE: 029
08 CONG DIST.: 02

09 COORDINATES
LATITUDE: 4 0° 0 3' 5 0". N
LONGITUDE: 0 7 4° 1 1' 1 0". W

10 TYPE OF OWNERSHIP (Check one)
_ A. PRIVATE _ B. FEDERAL _____ _ C. STATE
_ D. COUNTY X E. MUNICIPAL _ F. OTHER _____
_ G. UNKNOWN

III. INSPECTION INFORMATION

01 DATE OF INSPECTION: 08/ 29 / 84 (MONTH DAY YEAR)

02 SITE STATUS
ACTIVE
X INACTIVE

03 YEARS OF OPERATION
1955 / 1968 (BEGINNING YEAR / ENDING YEAR)
_ UNKNOWN

AGENCY PERFORMING INSPECTION (Check all that apply)
_ A. EPA X B. EPA CONTRACTOR NUS Corporation (Name of firm)
_ C. MUNICIPAL _ D. MUNICIPAL CONTRACTOR _____ (Name of firm)
_ E. STATE _ F. STATE CONTRACTOR _____ (Name of firm)
_ G. OTHER _____ (Specify)

05 CHIEF INSPECTOR	06 TITLE	07 ORGANIZATION	08 TELEPHONE NO.
Maurice Bulris	Chemist	NUS Corporation	(201) 225-6160
09 OTHER INSPECTORS	**10 TITLE**	**11 ORGANIZATION**	**12 TELEPHONE NO.**
William Neal	Environmental Scientist	NUS Corporation	(201) 225-6160
Pamela Kaneta	Biologist	NUS Corporation	(201) 225-6160
Tony Russo	Biologist	NUS Corporation	(201) 225-6160

13 SITE REPRESENTATIVES INTERVIEWED	14 TITLE	15 ADDRESS	16 TELEPHONE NO.
Mr. Carlson	Superintendant	Dept. of Public Works, Lakewood Township	(201) 363-0557

17 ACCESS GAINED BY (Check one)	18 TIME OF INSPECTION	19 WEATHER CONDITIONS
X PERMISSION _ WARRANT	1045	Warm, clear, 85°F

IV. INFORMATION AVAILABLE FROM

01 CONTACT	02 OF (Agency/Organization)	03 TELEPHONE NO.
Diana Messina	U.S. EPA, Region II	(201) 321-6685

04 PERSON RESPONSIBLE FOR SITE INSPECTION FORM	05 AGENCY	06 ORGANIZATION	07 TELEPHONE NO.	08 DATE
Pamela Kaneta/Daniel Caramagno		NUS Corp.	(201) 225-6160	7 / 3 / 86 (MONTH DAY YEAR)

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 2 - WASTE INFORMATION

1. IDENTIFICATION
01 STATE 02 SITE NUMBER
NJ D980529358

II. WASTE STATES, QUANTITIES, AND CHARACTERISTICS

01 PHYSICAL STATES (Check all that apply)

- X A. SOLID
- _ B. POWDER, FINES
- _ C. SLUDGE
- _ D. OTHER _____ (Specify)
- _ E. SLURRY
- _ F. LIQUID
- _ G. GAS

02 WASTE QUANTITY AT SITE (Measures of waste quantities must be independent)

TONS Unknown
CUBIC YARDS Unknown
NO. OF DRUMS Unknown

03 WASTE CHARACTERISTICS (Check all that apply)

- _ A. TOXIC
- _ B. CORROSIVE
- _ C. RADIOACTIVE
- _ D. PERSISTENT
- _ E. SOLUBLE
- _ F. INFECTIOUS
- _ G. FLAMMABLE
- _ H. IGNITABLE
- _ I. HIGHLY VOLATILE
- _ J. EXPLOSIVE
- _ K. REACTIVE
- _ L. INCOMPATIBLE
- X M. NOT APPLICABLE*

*Unknown as no definite waste, type is positively identified with the site.

III. WASTE TYPE

CATEGORY	SUBSTANCE NAME	01 GROSS AMOUNT	02 UNIT OF MEASURE	03 COMMENTS
SLU	SLUDGE	Unknown		Site is an inactive municipal landfill, therefore waste as deposited would be non-hazardous solids. The existence of hazardous waste is not known.
OLW	OILY WASTE	Unknown		
SOL	SOLVENTS	Unknown		
PSD	PESTICIDES	Unknown		
OCC	OTHER ORGANIC CHEMICALS	Unknown		
IOC	INORGANIC CHEMICALS	Unknown		
ACD	ACIDS	Unknown		
BAS	BASES	Unknown		
MES	HEAVY METALS	Unknown		

IV. HAZARDOUS SUBSTANCES (See Appendix for most frequently cited CAS Numbers)

CATEGORY	02 SUBSTANCE NAME	03 CAS NUMBER	04 STORAGE/DISPOSAL METHOD	05 CONCENTRATION	06 MEASURE OF CONCENTRATION
OCC	Carbon Disulfide	75-15-0	Found in stream sediment.	1600	ppb
MES	Lead	7439-92-1	Found in stream surface water.	300	ppb
MES	Iron	7439-89-6	Found in surface water and groundwater samples.	1,000,000	ppb

Note: These compounds were analyzed as present but are not necessarily attributable to the site inspected.

V. FEEDSTOCKS (See Appendix for CAS Numbers)

CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER	CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER
FDS	N/A		FDS		
FDS			FDS		
FDS			FDS		
FDS			FDS		

VI. SOURCES OF INFORMATION (See specific references. e.g., state files, sample analysis, reports)

Site Inspection performed by Region II FIT on August 29, 1984, field notes - NUS Edison.
Inorganic Analysis results, NUS Laboratory Services, Houston, TX - U.S. EPA.
Organic Analysis results, NUS Laboratory Services, Pittsburgh, PA - U.S. EPA.

II. HAZARDOUS CONDITIONS AND INCIDENTS

01 X A. GROUNDWATER CONTAMINATION — 02 _ OBSERVED (DATE: _____) — X POTENTIAL — _ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: 38,000 — 04 NARRATIVE DESCRIPTION

Several private wells exist in residences throughout the area. Health Department officials have tested these wells and only one had evidence of contamination with 1,1,1-trichloroethane and this is an isolated case with no attributable source. In addition several municipal wells serving the local community are within three miles of the site.

01. X B. SURFACE WATER CONTAMINATION — 02 _ OBSERVED (DATE: _____) — X POTENTIAL — _ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: 0 — 04 NARRATIVE DESCRIPTION

On site streams feed the Cedar Bridge Branch Creek which in turn enters the Metedeconk River and Barneget Bay. However, there are no surface water intakes on the river and recreational use is beyond three miles.

01 _ C. CONTAMINATION OF AIR — 02 _ OBSERVED (DATE: _____) — _ POTENTIAL — _ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: _____ — 04 NARRATIVE DESCRIPTION

No potential exists as air monitoring during the site inspection did not record readings above background. In addition the site has no past history of air contamination.

01. _ D. FIRE/EXPLOSIVE CONDITIONS — 02 _ OBSERVED (DATE: _____) — _ POTENTIAL — _ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: _____ — 04 NARRATIVE DESCRIPTION

No potential. Site is an old landfill with no record of hazardous waste activity causing a fire hazard.

01. X E. DIRECT CONTACT — 02 _ OBSERVED (DATE: _____) — X POTENTIAL — _ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: 1600 — 04 NARRATIVE DESCRIPTION

A low potential as landfill has had past history of poor security. Contact may occur if waste (if present) leaches to surface water or soil on site. A fence does not surround the property.

01 X F. CONTAMINATION OF SOIL — 02 _ OBSERVED (DATE: _____) — X POTENTIAL — _ ALLEGED
03 AREA POTENTIALLY AFFECTED: 60 (ACRES) — 04 NARRATIVE DESCRIPTION

Site is an old uncapped municipal landfill. Contamination from buried waste is possible.

01. X G. DRINKING WATER CONTAMINATION — 02 _ OBSERVED (DATE: _____) — X POTENTIAL — _ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: 38,000 — 04 NARRATIVE DESCRIPTION

Towns in the area are served by groundwater. Both private and public supply wells exist near the site. Several homes across the street and to the west of the site have shallow wells. A municipal well, drilled to a depth of 80', is less than a mile from the site. There are deeper municipal wells (600' or more) within one to three miles.

01 X H. WORKER EXPOSURE/INJURY — 02 _ OBSERVED (DATE: _____) — X POTENTIAL — _ ALLEGED
03 WORKERS POTENTIALLY AFFECTED: 6 — 04 NARRATIVE DESCRIPTION

Low potential as landfill now contains a composting operation. The landfill is inactive.

01 X I. POPULATION EXPOSURE/INJURY — 02 _ OBSERVED (DATE: _____) — X POTENTIAL — _ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: 2100 — 04 NARRATIVE DESCRIPTION

A potential of population exposure exists as a result of groundwater contamination and direct contact.

II. HAZARDOUS CONDITIONS AND INCIDENTS (Continued)

01 X J. DAMAGE TO FLORA 02 _ OBSERVED (DATE: _____) _ POTENTIAL X ALLEGED
04 NARRATIVE DESCRIPTION

Potential exists as on site streams pass through freshwater marsh land. A cranberry bog was removed downstream from the site for fear of contamination.

01 X K. DAMAGE TO FAUNA 02 _ OBSERVED (DATE: _____) X POTENTIAL _ ALLEGED
04 NARRATIVE DESCRIPTION (Include name(s) of species)

Animal life around the marshland near the site may be affected.

01 X L. CONTAMINATION OF FOOD CHAIN 02 _ OBSERVED (DATE: _____) X POTENTIAL _ ALLEGED
04 NARRATIVE DESCRIPTION

A potential exists for contamination of food chain organisms in the marshland.

01 X M. UNSTABLE CONTAINMENT OF WASTES 02 _ OBSERVED (DATE: _____) X POTENTIAL _ ALLEGED
(Spills/runoff/standing liquids/leaking drums)
03 POPULATION POTENTIALLY AFFECTED: 38,000 04 NARRATIVE DESCRIPTION

If hazardous waste is buried in the landfill there is no liner or cap to prevent groundwater or surface water contamination.

01 X N. DAMAGE TO OFFSITE PROPERTY 02 _ OBSERVED (DATE: _____) _ POTENTIAL X ALLEGED
04 NARRATIVE DESCRIPTION

A cranberry bog was removed from the Cedar Bridge Branch stream downstream of the site. Fear of pollution was the reason for this action.

01 X O. CONTAMINATION OF SEWERS, STORM DRAINS, WWTPs 02 _ OBSERVED (DATE: _____) X POTENTIAL _ ALLEGED
04 NARRATIVE DESCRIPTION

Contamination of drains along New Hampshire Avenue exists, however potential is very low because land is generally flat with only a gentle site slope away from New Hampshire Avenue.

01 X P. ILLEGAL/UNAUTHORIZED DUMPING 02 _ OBSERVED (DATE: _____) _ POTENTIAL X ALLEGED
04 NARRATIVE DESCRIPTION

Site is under inspection due to unconfirmed reports of chemical drums buried on site.

05 DESCRIPTION OF ANY OTHER KNOWN, POTENTIAL, OR ALLEGED HAZARDS

III. TOTAL POPULATION POTENTIALLY AFFECTED: 38,000

IV. COMMENTS

V. SOURCES OF INFORMATION (Cite specific references. e.g., state files, sample analysis, reports)

Telecon with Mr. Goldman, Ocean County Health Officer, and Jerry Cirilli of NUS Corp., - 6/1/84.
Telecon with Mr. Dubnick, Agricultural Extension Service and Daniel Caramagno of NUS Corp., 7/1/86 - NUS Corp.
Telecon with Mr. Chiapetta of NJ Water Co. and Daniel Caramagno of NUS Corp., 7/2/86 - NUS Corp.
Telecon with Mr. Shalman of South Lakewood Water and Daniel Caramagno of NUS Corp., 7/2/86 - NUS Corp.
"Water Supply Overlay Map Number 29" New Jersey Department of Environmental Protection, 1975 - NUS Corp.
U.S. Topographic 7.5 minute series, Lakewood Quadrangle, U.S. Department of the Interior, Revised 1971 - NUS Corp.
Telecon with Mr. Laffey of NJDEP and of NUS 6/1/84 - NUS Corp.

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 4 - PERMIT AND DESCRIPTIVE INFORMATION

1. IDENTIFICATION
01 STATE 02 SITE NUMBER
NJ D980529358

II. PERMIT INFORMATION

01 TYPE OF PERMIT ISSUED (Check all that apply)	02 PERMIT NUMBER	03 DATE ISSUED	04 EXPIRATION DATE	05 COMMENTS
_ A. NPDES				
_ B. UIC				
_ C. AIR				
_ D. RCRA				
_ E. RCRA INTERIM STATUS				
_ F. SPCC PLAN				
X G. STATE (Specify) NJPDES	Pending	N/A	N/A	The Town of Lakewood is currently applying for a NJPDES permit for groundwater.
_ H. LOCAL (Specify)				
_ I. OTHER (Specify)				
_ J. NONE				

III. SITE DESCRIPTION

01 Storage/Disposal (Check all that apply)	02 AMOUNT	03 UNIT OF MEASURE
_ A. SURFACE IMPOUNDMENT		
_ B. PILES		
_ C. DRUMS, ABOVE GROUND		
_ D. TANK, ABOVE GROUND		
_ E. TANK, BELOW GROUND		
X F. LANDFILL	Unknown	
_ G. LANDFARM		
_ H. OPEN DUMP		
_ I. OTHER (Specify)		

04 TREATMENT (Check all that apply)
- _ A. INCINERATION
- _ B. UNDERGROUND INJECTION
- _ C. CHEMICAL/PHYSICAL
- _ D. BIOLOGICAL
- _ E. WASTE OIL PROCESSING
- _ F. SOLVENT RECOVERY
- _ G. OTHER RECYCLING/RECOVERY
- _ H. OTHER (Specify)

05 OTHER
- X A. BUILDINGS ON SITE

06 AREA OF SITE
60 (Acres)

07 COMMENTS

Site is a municipal landfill which was closed before strict federal and state laws concerning solid waste were passed. The landfill is uncapped and without a liner. This may cause concern if chemical waste is buried on site.

IV. CONTAINMENT

01 CONTAINMENT OF WASTES (Check one)

_ A. ADEQUATE, SECURE _ B. MODERATE _ C. INADEQUATE, POOR X D. INSECURE, UNSOUND, DANGEROUS

02 DESCRIPTION OF DRUMS, DIKING, LINERS, BARRIERS, ETC.

Landfill was built in the 1950's for municipal waste and as a result is unlined and not capped with no run-off control.

V. ACCESSIBILITY

01 WASTE EASILY ACCESSIBLE: X YES _ NO

02 COMMENTS

Site is not completely fenced, however, waste is buried. If contact occurs it would be with contaminated leachate present on site.

VI SOURCES OF INFORMATION (Cite specific references. e.g., state files, sample analysis, reports)

Telecon with Mr. Temassoni of NJDEP and Daniel Caramagno of NUS Corp., 7/7/86 - NUS Corp.
Site Inspection of 8/29/84, Field Notes - NUS Corp.

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 5 - DEMOGRAPHIC, AND ENVIRONMENTAL DATA

1. IDENTIFICATION
01 STATE 02 SITE NUMBER
NJ D980529358

II. DRINKING WATER SUPPLY

01 TYPE OF DRINKING SUPPLY (Check as applicable)	SURFACE	WELL	02 STATUS ENDANGERED	AFFECTED	MONITORED	03 DISTANCE TO SITE
COMMUNITY	A. _	B. X	A. X	B. _	C. _	A. 0.75 (mi)
NON-COMMUNITY	C. _	D. X	D. X	E. _	F. _	B. 0.10 (mi)

III. GROUNDWATER

01 GROUNDWATER USE IN VICINITY (Check one)

X A. ONLY SOURCE FOR DRINKING _ B. DRINKING (Other sources available) COMMERCIAL, INDUSTRIAL, IRRIGATION (No other water sources available) _ C. COMMERCIAL, INDUSTRIAL, IRRIGATION (Limited other sources available) _ D. NOT USED, UNUSEABLE

02 POPULATION SERVED BY GROUND WATER: 38,000 03 DISTANCE TO NEAREST DRINKING WATER WELL: 0.10 (mi)

04 DEPTH TO GROUNDWATER	05 DIRECTION OF GROUNDWATER FLOW	06 DEPTH TO AQUIFER OF CONCERN	07 POTENTIAL YIELD OF AQUIFER	08 SOLE SOURCE AQUIFER
35 (ft)	Southeast	35 (ft)	Unknown (gpd)	X YES _ NO

09 DESCRIPTION OF WELLS (Including useage, depth, and location relative to population and buildings)

The closest wells are shallow (40-50 feet) private wells located in a development to the west of the site. The closest well is 0.10 miles away. Municipal wells also serve the surrounding community. The closest municipal well is 0.75 miles away and it is 80' deep. The remaining municipal wells are 1-3 miles away and tap a much deeper aquifer at about 600 or more feet.

10 RECHARGE AREA

X YES
_ NO

COMMENTS Aquifers in the area are fed by precipitation.

11. DISCHARGE AREA

X YES
_ NO

COMMENTS Surface water in the area is fed by groundwater. The site contains some surface water streams.

IV. SURFACE WATER

01 SURFACE WATER USE (Check one)

X A. RESERVOIR, RECREATION* DRINKING WATER SOURCE *Recreational use only. This use is beyond three stream miles. _ B. IRRIGATION, ECONOMICALLY IMPORTANT RESOURCES _ C. COMMERCIAL, INDUSTRIAL _ D. NOT CURRENTLY USED

02 AFFECTED/POTENTIALLY AFFECTED BODIES OF WATER

NAME:	AFFECTED	DISTANCE TO SITE
Cedar Bridge Branch Creek		On Site (mi)
Metedeconk River		3.0 (mi)
Barneget Bay		7.0 (mi)

V. DEMOGRAPHIC AND PROPERTY INFORMATION

01 TOTAL POPULATION WITHIN

ONE (1) MILE OF SITE	TWO (2) MILES OF SITE	THREE (3) MILES OF SITE
A. 1,600 NO. OF PERSONS	B. 12,800 NO. OF PERSONS	C. 35,800 NO. OF PERSONS

02 DISTANCE TO NEAREST POPULATION: 0.10 (mi)

03 NUMBER OF BUILDINGS WITHIN TWO (2) MILES OF SITE	04 DISTANCE TO NEAREST OFF-SITE BUILDING
6200	0.10 (mi)

05 POPULATION WITHIN VICINITY OF SITE (Provide narrative description of nature of population within vicinity of site. e.g., rural, village, densely populated urban area)

The site is located on New Hampshire Avenue in Lakewood Township. West of the site (across New Hampshire Avenue) is a residential development. Industrial property is adjacent to the site to the north and south and to the east is Lakewood Airport. Residential property becomes denser two miles west and northwest of the site.

VI. ENVIRONMENTAL INFORMATION

01 PERMEABILITY OF UNSATURATED ZONE (Check one)

_ A. 10^{-6} - 10^{-8} cm/sec _ B. 10^{-4} - 10^{-6} cm/sec _ C. 10^{-4} - 10^{-3} cm/sec X D. GREATER THAN 10^{-3} cm/sec

02 PERMEABILITY OF BEDROCK (Check one)

_ A. IMPERMEABLE (Less than 10^{-6} cm/sec) X B. RELATIVELY IMPERMEABLE (10^{-4} - 10^{-6} cm/sec) _ C. RELATIVELY PERMEABLE (10^{-2} - 10^{-4} cm/sec) _ D. VERY PERMEABLE (Greater than 10^{-2} cm/sec)

03 DEPTH TO BEDROCK	04 DEPTH OF CONTAMINATED SOIL ZONE	05 SOIL pH
1700 (ft)	Unknown (ft)	6.0

06 NET PRECIPITATION	07 ONE YEAR 24 HOUR RAINFALL	08 SLOPE SITE SLOPE	DIRECTION OF SITE SLOPE	TERRAIN AVERAGE SLOPE
14 (in)	2.75 (in)	0-1 %	Southeast	0-1 %

09 FLOOD POTENTIAL 10

SITE IS IN 100 YEAR FLOODPLAIN _ SITE IS ON BARRIER ISLAND, COASTAL HIGH HAZARD AREA, RIVERINE FLOODWAY

11 DISTANCE TO WETLANDS (5 acre minimum)

ESTUARINE OTHER

A. >2 (mi) B. <0.1 (mi)

12 DISTANCE TO CRITICAL HABITAT (of endangered species)

None within one mile (mi)

ENDANGERED SPECIES: N/A

13 LAND USE IN VICINITY

DISTANCE TO:

COMMERCIAL/INDUSTRIAL	RESIDENTIAL AREAS: NATIONAL/STATE PARKS, FORESTS, OR WILDLIFE RESERVES	AGRICULTURAL LANDS PRIME AG LAND	AGRICULTURAL LANDS AG LAND
A. 0.1 (mi)	B. 0.1 (mi)	C. 2.5 (mi)	D. 2.5 (mi)

14 DESCRIPTION OF SITE IN RELATION TO SURROUNDING TOPOGRAPHY

The site is located in flat land not too distant from the New Jersey shore. As a result the land is extremely marshy with several streams nearby. These streams flow through marsh area and eventually to Barneget Bay to the east. The topography of the area is relatively flat (0-1% slope west to east) and sandy and devoid of any distinctive topographic features. The area has undergone extensive urban development in recent years.

VII SOURCES OF INFORMATION (Cite specific references e.g., state files, sample analysis, reports)

Telecon between Mr. Dubnick of the Agricultural Extension of Ocean County and Daniel Caramagno of NUS Corp. - 7/1/86 - NUS Corp.
Telecon between Mr. Hunnerell, of NJDEP and Daniel Caramagno of NUS Corp. - 7/1/86 - NUS Corp.
Telecon between MR. Chiapetta of NJ Water Co. and Daniel Caramagno of NUS Corp. 7/2/86 - NUS Corp.
Telecon between Mr. Shaiman of Lakewood Water and Daniel Caramagno of NUS Corp. 7/2/86 - NUS Corp.
Special Report #29, Geology and Groundwater Resources of Ocean County, New Jersey Department of Conservation and Economic Development, 1969 - NUS Corp.
Site Inspection of 8/29/84, Field Notes - NUS Corp.

II. SAMPLES TAKEN

SAMPLE TYPE	01 NUMBER OF SAMPLES TAKEN	02 SAMPLES SENT TO	03 ESTIMATED DATE RESULTS AVAILABLE
GROUNDWATER	2	Organic samples sent to: NUS Laboratory Services 5350 Cambell's Run Road Pittsburgh, PA 15205	11/84
SURFACE WATER	2		
WASTE			
AIR			
RUNOFF			
SPILL		Inorganic samples sent to: NUS Laboratory Services 900 Gemini Houston, TX 77058	11/84
SOIL	4		
VEGETATION			
OTHER			

III. FIELD MEASUREMENTS TAKEN

01 TYPE	02 COMMENTS
Air Measurements	An on site survey of air contamination was completed using an organic vapor analyzer (OVA) and a photometric vapor analyzer (HNu).

IV. PHOTOGRAPHS AND MAPS

01 TYPE X GROUND _ AERIAL

02 IN CUSTODY OF NUS Corporation
(Name of organization or individual)

03 MAPS

X YES
_ NO

04 LOCATION OF MAPS

NUS Corporation, Edison, NJ

V. OTHER FIELD DATA COLLECTED (Provide narrative description)

Field Notebook #984 used for documentation on 08/29/84. The notebook is available at Region II FIT office and is filed under TDD #02-8403-109A.

VI. SOURCES OF INFORMATION (Cite specific references. e.g., state files, sample analysis, reports)

Site Inspection of 8/29/84, Field Notes - NUS Corp.
Inorganic Analytical Results, NUS Laboratory Services, Houston, TX - U.S. EPA.
Organic Analytical Results, NUS Laboratory Services, Pittsburgh, PA - U.S. EPA.

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 7 - OWNER INFORMATION

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
NJ	D980529358

II. CURRENT OWNER(S) / PARENT COMPANY (If applicable)

01 NAME	02 D + B NUMBER	08 NAME	09 D + B NUMBER
Township of Lakewood			
03 STREET ADDRESS (P.O. Box, RFD#, etc.)	04 SIC CODE	10 STREET ADDRESS (P.O. Box, RFD#, etc.)	11 SIC CODE
231 3rd Street			

05 CITY	06 STATE	07 ZIP CODE	12 CITY	13 STATE	14 ZIP CODE
Lakewood	NJ	08701			

01 NAME	02 D + B NUMBER	08 NAME	09 D + B NUMBER
03 STREET ADDRESS (P.O. Box, RFD#, etc.)	04 SIC CODE	10 STREET ADDRESS (P.O. Box, RFD#, etc.)	11 SIC CODE

05 CITY	06 STATE	07 ZIP CODE	12 CITY	13 STATE	14 ZIP CODE

01 NAME	02 D + B NUMBER	08 NAME	09 D + B NUMBER
03 STREET ADDRESS (P.O. Box, RFD#, etc.)	04 SIC CODE	10 STREET ADDRESS (P.O. Box, RFD#, etc.)	11 SIC CODE

05 CITY	06 STATE	07 ZIP CODE	12 CITY	13 STATE	14 ZIP CODE

01 NAME	02 D + B NUMBER	08 NAME	09 D + B NUMBER
03 STREET ADDRESS (P.O. Box, RFD#, etc.)	04 SIC CODE	10 STREET ADDRESS (P.O. Box, RFD#, etc.)	11 SIC CODE

05 CITY	06 STATE	07 ZIP CODE	12 CITY	13 STATE	14 ZIP CODE

III. PREVIOUS OWNER(S) (List most recent first) / IV. REALTY OWNER(S) (If applicable; list most recent first)

01 NAME	02 D + B NUMBER	01 NAME	02 D + B NUMBER
N/A		N/A	
03 STREET ADDRESS (P.O. Box, RFD#, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD#, etc.)	04 SIC CODE

05 CITY	06 STATE	07 ZIP CODE	05 CITY	06 STATE	07 ZIP CODE

01 NAME	02 D + B NUMBER	01 NAME	02 D + B NUMBER
03 STREET ADDRESS (P.O. Box, RFD#, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD#, etc.)	04 SIC CODE

05 CITY	06 STATE	07 ZIP CODE	05 CITY	06 STATE	07 ZIP CODE

01 NAME	02 D + B NUMBER	01 NAME	02 D + B NUMBER
03 STREET ADDRESS (P.O. Box, RFD#, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD#, etc.)	04 SIC CODE

05 CITY	06 STATE	07 ZIP CODE	05 CITY	06 STATE	07 ZIP CODE

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

Telecon between Mr. Carlson, Lakewood Township and Daniel Caramagno of NUS Corp. 7/2/86 - NUS Corp.
Site Inspection of 8/29/84, Field Notes - NUS Corp.

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 8 - OPERATOR INFORMATION

1. IDENTIFICATION
01 STATE 02 SITE NUMBER
NJ D980529358

II. CURRENT OPERATOR(S) — OPERATOR'S PARENT COMPANY (If applicable)

01 NAME	02 D + B Number	10 NAME	11 D + B NUMBER
N/A			
03 STREET ADDRESS (P.O. Box, RFD#, etc.)	04 SIC CODE	12 STREET ADDRESS (P.O. Box, RFD#, etc.)	13 SIC CODE
05 CITY 06 STATE	07 ZIP CODE	14 CITY 15 STATE	16 ZIP CODE
08 YEARS OF OPERATION 09 NAME OF OWNER			

III. PREVIOUS OPERATOR(S) (List most recent first: Provide only if different from owner) — PREVIOUS OPERATOR'S PARENT COMPANIES (If applicable)

01 NAME	02 D + B Number	10 NAME	11 D + B NUMBER
(Same as current owner)			
03 STREET ADDRESS (P.O. Box, RFD#, etc.)	04 SIC CODE	12 STREET ADDRESS (P.O. Box, RFD#, etc.)	13 SIC CODE
05 CITY 06 STATE	07 ZIP CODE	14 CITY 15 STATE	16 ZIP CODE
08 YEARS OF OPERATION 09 NAME OF OWNER			

01 NAME	02 D + B Number	10 NAME	11 D + B NUMBER
03 STREET ADDRESS (P.O. Box, RFD#, etc.)	04 SIC CODE	12 STREET ADDRESS (P.O. Box, RFD#, etc.)	13 SIC CODE
05 CITY 06 STATE	07 ZIP CODE	14 CITY 15 STATE	16 ZIP CODE
08 YEARS OF OPERATION 09 NAME OF OWNER			

01 NAME	02 D + B Number	10 NAME	11 D + B NUMBER
03 STREET ADDRESS (P.O. Box, RFD#, etc.)	04 SIC CODE	12 STREET ADDRESS (P.O. Box, RFD#, etc.)	13 SIC CODE
05 CITY 06 STATE	07 ZIP CODE	14 CITY 15 STATE	16 ZIP CODE
08 YEARS OF OPERATION 09 NAME OF OWNER			

IV. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

Site Inspection 8/29/84, Field Notes - NUS Corp.
Telecon with Mr. Carlson 7/2/86 - NUS Corp.

II ON-SITE GENERATOR

01 NAME | 02 D + B NUMBER

03 STREET ADDRESS (P.O. Box, RFD#, etc.) | 04 SIC CODE

05 CITY | 06 STATE | 07 ZIP CODE

III OFF-SITE GENERATOR(S)

01 NAME	02 D + B NUMBER	01 NAME	02 D + B NUMBER
Town of Lakewood 03 STREET ADDRESS (P.O. Box, RFD#, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD#, etc.)	04 SIC CODE
(Same as Current Owner) 05 CITY	06 STATE / 07 ZIP CODE	05 CITY	06 STATE / 07 ZIP CODE
01 NAME	02 D + B NUMBER	01 NAME	02 D + B NUMBER
03 STREET ADDRESS (P.O. Box, RFD#, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD#, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	05 CITY	06 STATE / 07 ZIP CODE

IV. TRANSPORTER(S)

01 NAME	02 D + B NUMBER	01 NAME	02 D + B NUMBER
(Same as Current Owner) 03 STREET ADDRESS (P.O. Box, RFD#, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD#, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	05 CITY	06 STATE / 07 ZIP CODE
01 NAME	02 D + B NUMBER	01 NAME	02 D + B NUMBER
03 STREET ADDRESS (P.O. Box, RFD#, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD#, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	05 CITY	06 STATE / 07 ZIP CODE

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

Site Inspection 8/29/84 - NUS Corp.
Telecon with Mr. Carlson of Lakewood Township 7/2/86 - NUS Corp.

II. PAST RESPONSE ACTIVITIES

01 ___ A. WATER SUPPLY CLOSED — 02 DATE: _____ — 03 AGENCY: _____
04 DESCRIPTION

Not Applicable
01 ___ B. TEMPORARY WATER SUPPLY PROVIDED — 02 DATE: _____ — 03 AGENCY: _____
04 DESCRIPTION

Not Applicable
01 ___ C. PERMANENT WATER SUPPLY PROVIDED — 02 DATE: _____ — 03 AGENCY: _____
04 DESCRIPTION

Not Applicable
01 ___ D. SPILLED MATERIAL REMOVED — 02 DATE: _____ — 03 AGENCY: _____
04 DESCRIPTION

Not Applicable
01 ___ E. CONTAMINATED SOIL REMOVED — 02 DATE: _____ — 03 AGENCY: _____
04 DESCRIPTION

Not Applicable
01 ___ F. WASTE REPACKAGED — 02 DATE: _____ — 03 AGENCY: _____
04 DESCRIPTION

Not Applicable
01 ___ G. WASTE DISPOSED ELSEWHERE — 02 DATE: _____ — 03 AGENCY: _____
04 DESCRIPTION

Not Applicable
01 ___ H. ON SITE BURIAL — 02 DATE: _____ — 03 AGENCY: _____
04 DESCRIPTION

Not Applicable
01 ___ I. IN SITU CHEMICAL TREATMENT — 02 DATE: _____ — 03 AGENCY: _____
04 DESCRIPTION

Not Applicable
01 ___ J. IN SITU BIOLOGICAL TREATMENT — 02 DATE: _____ — 03 AGENCY: _____
04 DESCRIPTION

Not Applicable
01 ___ K. IN SITU PHYSICAL TREATMENT — 02 DATE: _____ — 03 AGENCY: _____
04 DESCRIPTION

Not Applicable
01 ___ L. ENCAPSULATION — 02 DATE: _____ — 03 AGENCY: _____
04 DESCRIPTION

Not Applicable
01 ___ M. EMERGENCY WASTE TREATMENT — 02 DATE: _____ — 03 AGENCY: _____
04 DESCRIPTION

Not Applicable
01 ___ N. CUTOFF WALLS — 02 DATE: _____ — 03 AGENCY: _____
04 DESCRIPTION

Not Applicable

01 ___ O. EMERGENCY DIKING/SURFACE WATER DIVERSION — 02 DATE: _____ — 03 AGENCY: _____
04 DESCRIPTION

Not Applicable
01 ___ P. CUTOFF TRENCHES/SUMP — 02 DATE: _____ — 03 AGENCY: _____
04 DESCRIPTION

Not Applicable
01 ___ Q. SUBSURFACE CUTOFF WALL — 02 DATE: _____ — 03 AGENCY: _____
04 DESCRIPTION

Not Applicable

II. PAST RESPONSE ACTIVITIES

01 ___ R. BARRIER WALLS CONSTRUCTED 02 DATE: _____ 03 AGENCY: _____
04 DESCRIPTION

Not Applicable
01 ___ S. CAPPING/COVERING 02 DATE: _____ 03 AGENCY: _____
04 DESCRIPTION

Not Applicable
01 ___ T. BULK TANKAGE REPAIRED 02 DATE: _____ 03 AGENCY: _____
04 DESCRIPTION

Not Applicable
01 ___ U. GROUT CURTAIN CONSTRUCTED 02 DATE: _____ 03 AGENCY: _____
04 DESCRIPTION

Not Applicable
01 ___ V. BOTTOM SEALED 02 DATE: _____ 03 AGENCY: _____
04 DESCRIPTION

Not Applicable
01 ___ W. GAS CONTROL 02 DATE: _____ 03 AGENCY: _____
04 DESCRIPTION

Not Applicable
01 ___ X. FIRE CONTROL 02 DATE: _____ 03 AGENCY: _____
04 DESCRIPTION

Not Applicable
01 ___ Y. LEACHATE TREATMENT 02 DATE: _____ 03 AGENCY: _____
04 DESCRIPTION

Not Applicable
01 ___ Z. AREA EVACUATED 02 DATE: _____ 03 AGENCY: _____
04 DESCRIPTION

Not Applicable
01 ___ 1. ACCESS TO SITE RESTRICTED 02 DATE: _____ 03 AGENCY: _____
04 DESCRIPTION

Not Applicable
01 ___ 2. POPULATION RELOCATED 02 DATE: _____ 03 AGENCY: _____
04 DESCRIPTION

Not Applicable
01 ___ 3. OTHER REMEDIAL ACTIVITIES 02 DATE: _____ 03 AGENCY: _____
04 DESCRIPTION

Not Applicable

III. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

Telecon between Mr. Hayton of NJDEP and Daniel Caramagno of NUS Corp., 7/2/86 - NUS Corp.

II. ENFORCEMENT INFORMATION

01 PAST REGULATORY/ENFORCEMENT ACTION X YES _ NO

02 DESCRIPTION OF FEDERAL, STATE, LOCAL REGULATORY/ENFORCEMENT ACTION

Town of Lakewood is now applying for a New Jersey Pollution Discharge Elimination Permit (NJPDES) for groundwater. They must place five wells around the landfill for groundwater monitoring.

III. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, report)

Telecon between Mr. Hayton of NJDEP and Daniel Caramagno of NUS Corp., 7/2/86 - NUS Corp.
Telecon between Mr. Tomassoni of NJDEP and Daniel Caramagno of NUS Corp., 7/7/86 - NUS Corp.

SECTION 3

MAPS AND PHOTOGRAPHS

APPENDIX A

MAPS AND PHOTOS

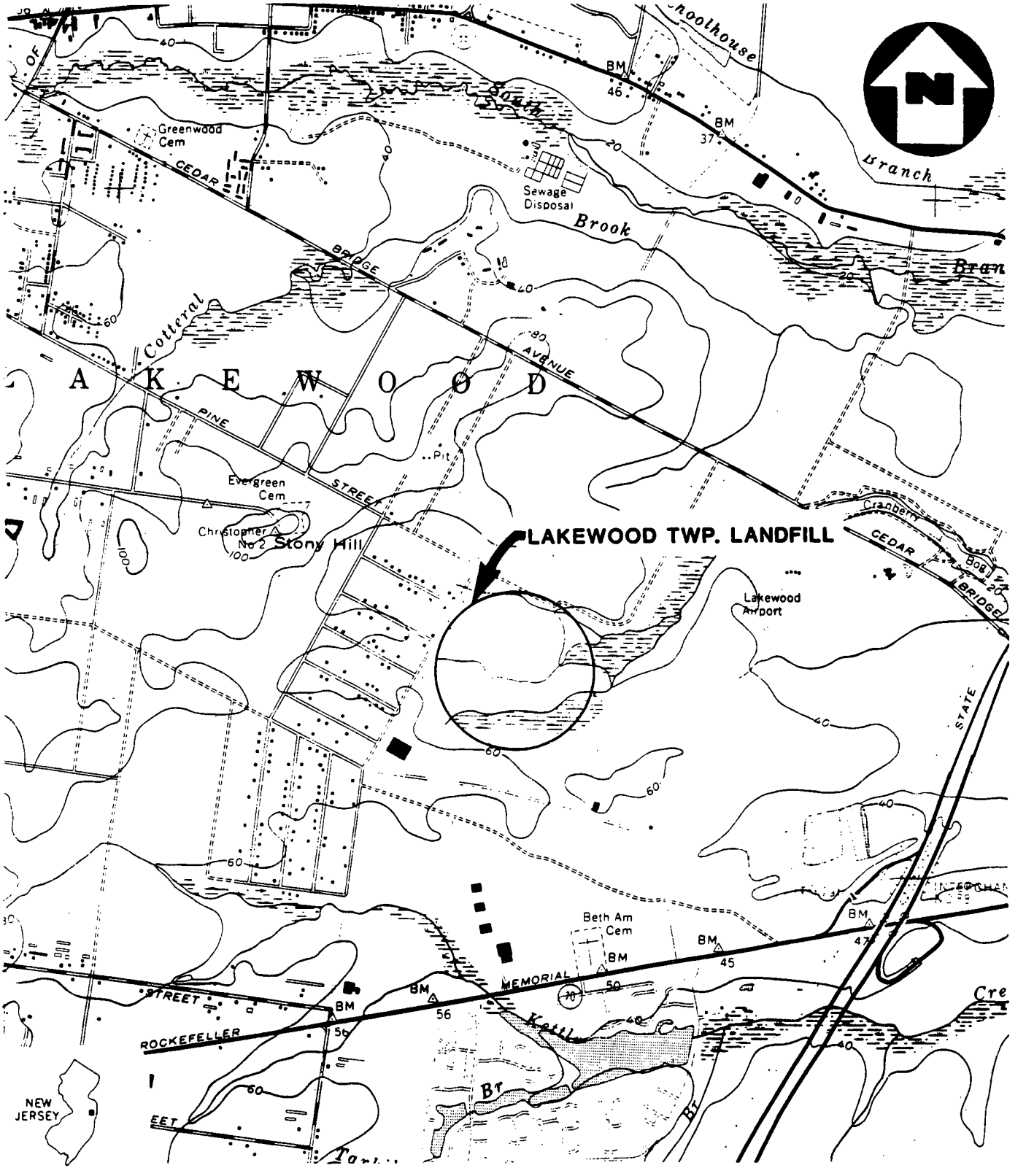
MAPS AND PHOTOS

Figure A-1 provides a Site Location Map.

Figure A-2 provides a Site Map.

Figure A-3 provides a Sample Location Map.

Exhibit A-1 provides photographs of the site.



(QUAD) LAKEWOOD, N.J.

FIGURE A-1

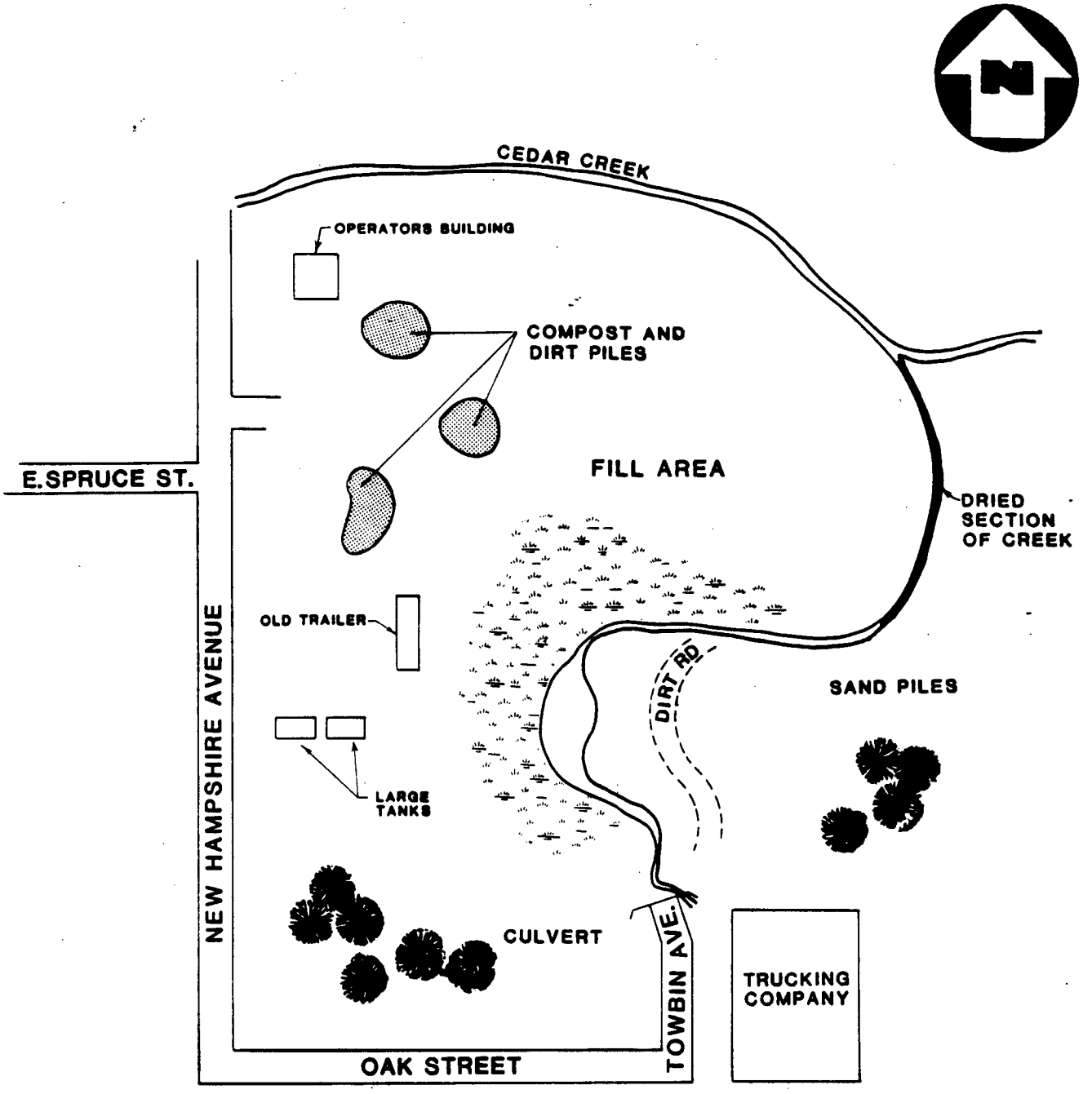
SITE LOCATION MAP

LAKEWOOD TWP. LANDFILL, LAKEWOOD, N.J.

SCALE: 1" = 2000'

NUS CORPORATION

A Halliburton Company



SITE MAP

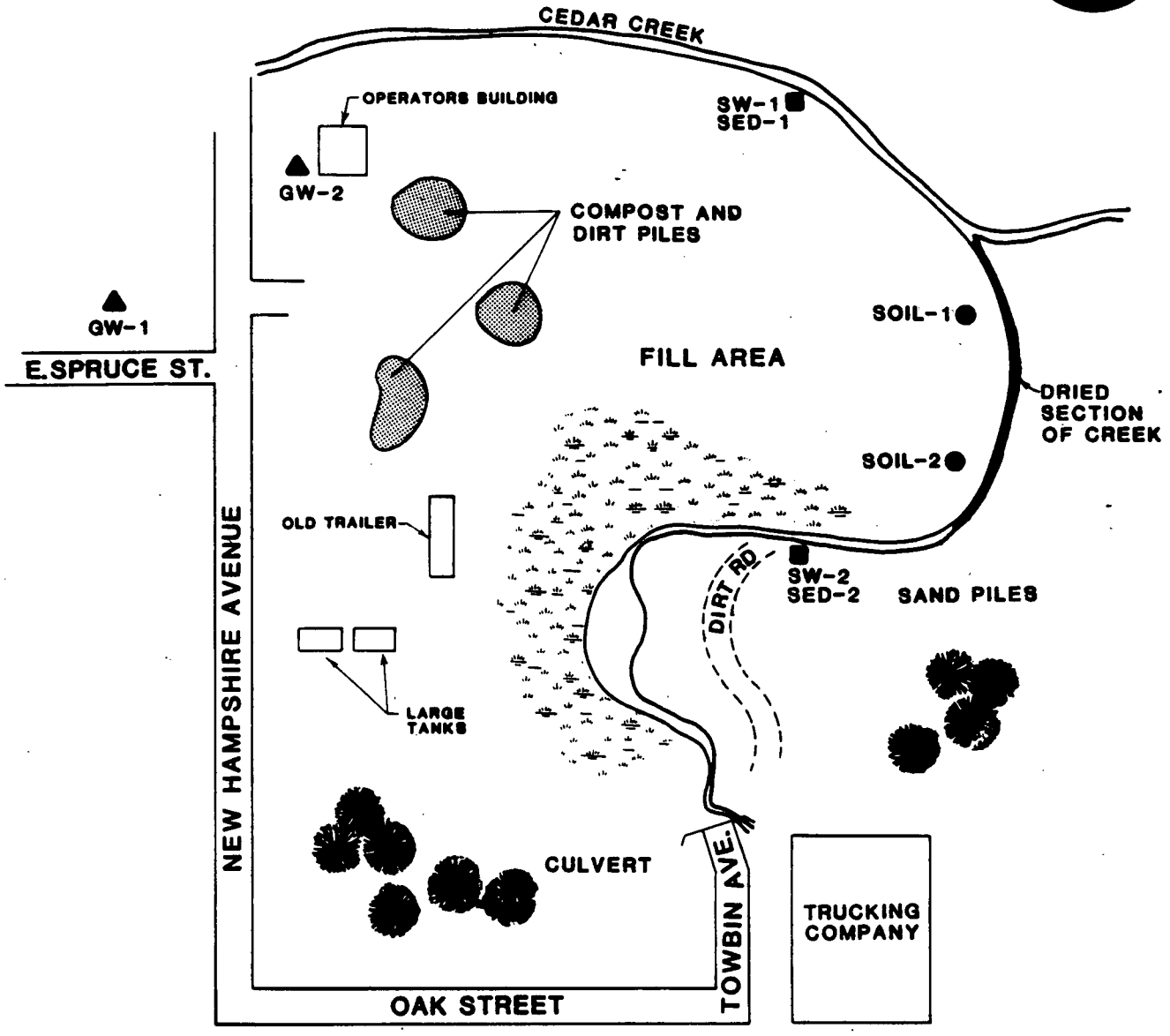
LAKEWOOD TWP. LANDFILL, LAKEWOOD, N.J.

(NOT TO SCALE)

FIGURE A-2

NUS CORPORATION

A Halliburton Company



LEGEND:

- ● SOIL SAMPLE
- ▲ GROUNDWATER SAMPLE
- ■ SURFACE WATER/SEDIMENT SAMPLE

SAMPLE LOCATION MAP

LAKEWOOD TWP. LANDFILL, LAKEWOOD, N.J.

(NOT TO SCALE)

FIGURE A-3

NUS CORPORATION

A Halliburton Company

EXHIBIT A-1
LAKEWOOD TWP. LANDFILL
LAKEWOOD, NEW JERSEY
August 29, 1984
TDD# 02-8403-109A

PHOTOGRAPH LOG

LAKEWOOD TWP. LANDFILL
LAKEWOOD, NEW JERSEY

PHOTOGRAPH INDEX

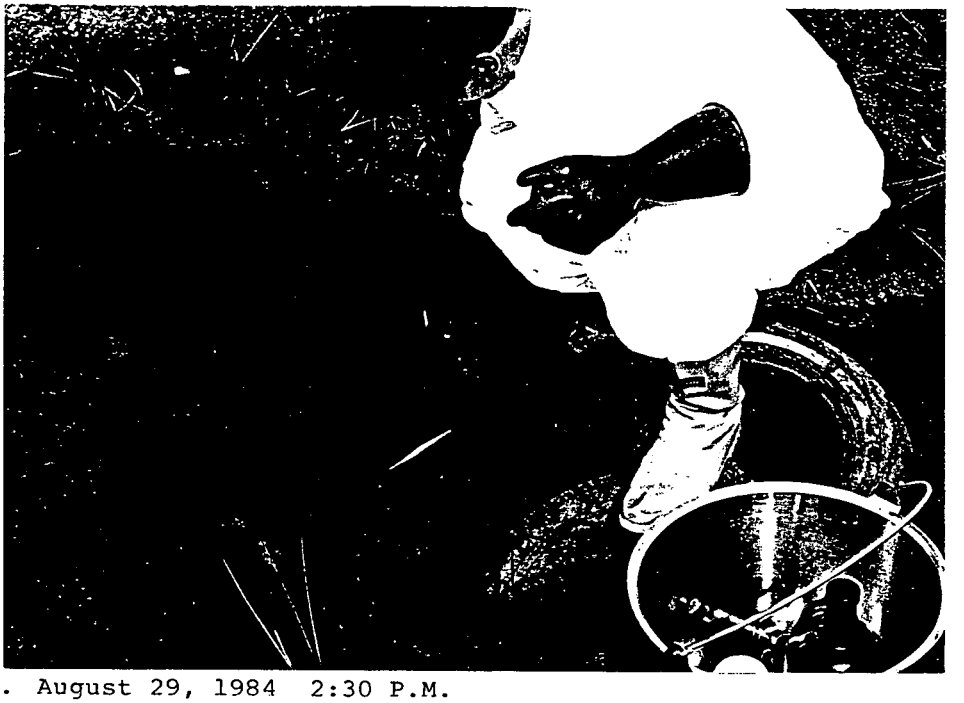
Photo Number	Description	Time
1.	August 29, 1984 Tony Russo collecting surface water from Cedar Creek at the western borders of the site, Sample #SW-1.	1:45 PM
2.	August 29, 1984 Tony Russo collecting sediment from Cedar Creek at the western borders of the site, Sample #SED-1.	1:45 PM
3.	August 29, 1984 Tony Russo collecting discolored soil from dried eastern section of creek, Sample #soil-1.	2:10 PM
4.	August 29, 1984 Tony Russo collecting discolored soil from dried section of creek near sand piles, Sample #soil-2.	2:15 PM
5.	August 29, 1984 Tony Russo collecting surface water from creek near sand piles, Sample #SW-2.	2:30 PM
6.	August 29, 1984 Pamela Kaneta collecting sediment sample from creek near sand piles, Sample #SED-2.	2:30 PM
7.	August 29, 1984 Bill Neal taking groundwater sample from well near road on site. Well in same aquifer as residence nearby, Sample #GW-2.	3:00 PM
8.	August 29, 1984 Tony Russo taking groundwater sample from the residence of G. Kloepper located across from site on E. Spruce Street, well approx. 50 feet deep, Sample GW-1.	4:00 PM

1. August 29, 1984 1:45 P.M.
   Tony Russo collecting surface water from Cedar Creek at the western borders of the site, sample # SW-1.

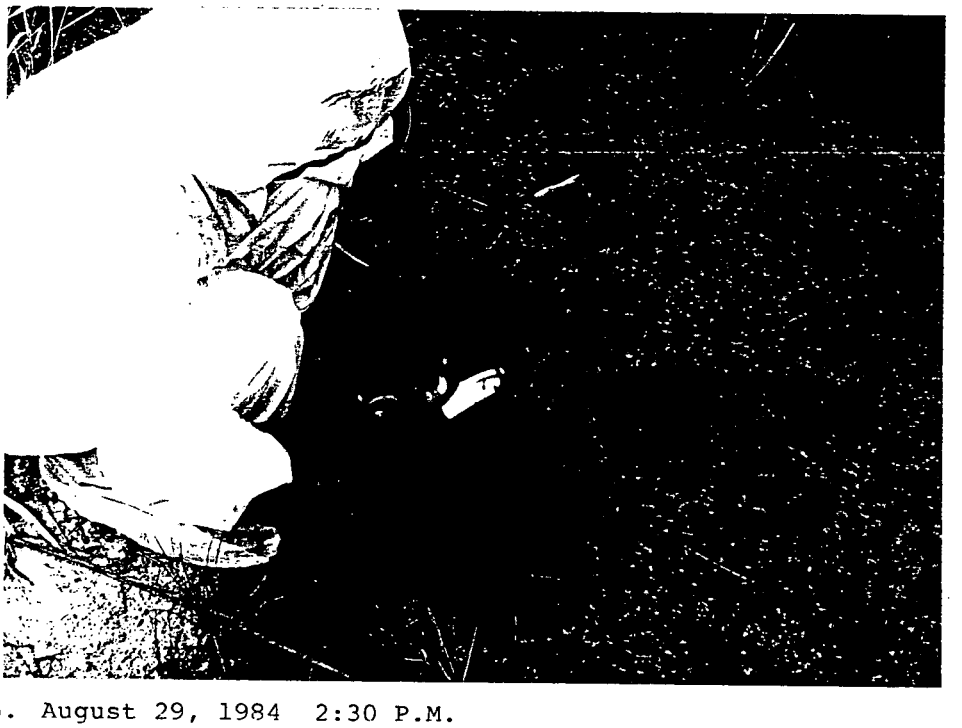
2. August 29, 1984 1:45 P.M.
   Tony Russo collecting sediment from Cedar Creek at the western borders of the site, sample # SED-1.

3. August 29, 1984 2:10 P.M.
Tony Russo collecting discolored soil from dried eastern section of creek, sample # SOIL-1.

4. August 29, 1984 2:15 P.M.
Tony Russo collecting discolored soil from dried section of creek near sand piles, sample # SOIL-2.

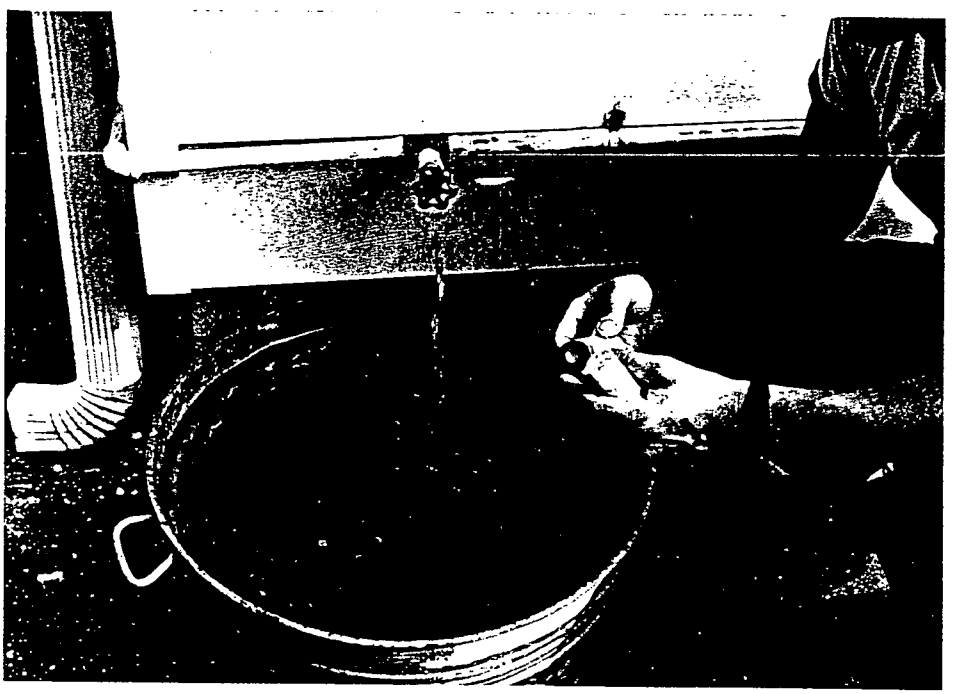


5. August 29, 1984 2:30 P.M.
Tony Russo collecting surface water from creek near sand piles, sample # SW-2.



6. August 29, 1984 2:30 P.M.
Pamela Kaneta collecting sediment sample from creek near sand piles, sample # SED-2.

7. August 29, 1984 3:00 P.M.
Bill Neal taking groundwater sample from well near road on site. Well in same aquifer as residence nearby, sample # GW-2.



8. August 29, 1984 4:00 P.M.
Tony Russo taking groundwater sample from the residence of G. Kloepper. Located across from site on E. Spruce St., well approx. 50 feet deep, sample # GW-1.

SECTION 4

DOCUMENTATION RECORDS FOR HAZARDOUS RANKING SYSTEM

FIT QUALITY ASSURANCE TEAM

DOCUMENTATION RECORDS

FOR

HAZARD RANKING SYSTEM

INSTRUCTIONS: As briefly as possible summarize the information you used to assign the score for each factor (e.g., "Waste quantity = 4,230 drums plus 800 cubic yards of sludges"). The source of information should be provided for each entry and should be a bibliographic-type reference. Include the location of the document.

FACILITY NAME: Lakewood Township Landfill

LOCATION: New Hampshire Avenue, Lakewood, NJ

DATE SCORED: July 17, 1986

PERSON SCORING: Daniel Caramagno

PRIMARY SOURCE(S) OF INFORMATION (e.g., EPA region, state, FIT, etc.):

FIT Region II Files

FIT Region II Library

FACTORS NOT SCORED DUE TO INSUFFICIENT INFORMATION:

COMMENTS OR QUALIFICATIONS:

The OVA (Organic Vapor Analyzer) was used during the site inspection on August 29, 1984. No readings above background were detected at the Lakewood Township Landfill. On this basis, the air route of the Mitre Model was scored a zero value.

The Town of Lakewood Fire Inspector does not consider the site a fire hazard and the Site Inspection revealed no fire hazard present as a result of hazardous waste activity. Therefore the fire route is not scored.

1 OBSERVED RELEASE

Contaminants detected (5 maximum):

Observed release is scored a "0" because no background water samples were obtained during the site inspection.

Rationale for attributing the contaminants to the facility:

N/A

* * *

2 ROUTE CHARACTERISTICS

Depth to Aquifer of Concern

Name/description of aquifer(s) of concern:

In Ocean County all groundwater occurs in the Coastal Plain sediments. These sediments average 3000 feet in depth and contain several aquifers.

Three aquifers are used within three miles of the site. The uppermost aquifer and the one of concern is the Cohansey Sands. The next deepest aquifer in use (700 feet below surface) is the Englishtown Formation, and the deepest aquifer of use is the Raritan-Magothy Formation at a depth of 1000 feet. The two deepest aquifers are tapped within three miles of the site by several municipal wells. These wells serve a combined population of over 38,000 people.

The Cohansey Aquifer a an unconsolidated aquifer. The depth to water is 35 feet below ground surface. Recharge to the aquifer is from precipitation, however, pumping from wells may induce recharge from surface water. This aquifer is tapped by several private wells and one major municipal well.

Ref: #6 pgs 12-14, 25, 32-36, 50-56
#10, #11, #12, #13

Depth(s) from the ground surface to the highest seasonal level of the saturated zone water table(s) of the aquifer of concern:

The upper level of the water table aquifer (Cohansey) is 35 feet below the ground surface.

Ref: #6 p. 52-56

Depth from the ground surface to the lowest point of waste disposal/storage:

Depth to waste is unknown as. The location or even the existence of hazardous waste on site is unknown. As a result, assume 6 feet.

Ref: #4

Net Precipitation

Mean annual or seasonal precipitation (list months for seasonal):

Total annual rainfall - 47 inches

Ref: #4, p. 14

Mean annual lake or seasonal evaporation (list months for seasonal):

Mean annual lake evaporation - 33 inches

Ref: #4, p. 13

Net precipitation (subtract the above figures):

14 inches

Permeability of Unsaturated Zone

Soil type in unsaturated zone:

Lakewood sands are within the first five feet of the surface. Gravel and sand are in the remaining depth of the unsaturated zone.

Ref: #2: Sheet #14, p. 73

Ref: #6, p. 21

Permeability associated with soil type:

Greater than 10^{-3} cm/sec

Ref: #2, p. 73

Ref: #4, p. 15

Physical State

Physical state of substances at time of disposal (or at present time for generated gases):

Solid

Ref: #13

3 CONTAINMENT

Containment

Method(s) of waste or leachate containment evaluated:

Landfill is unlined with alleged drum burial.

Ref: #15

Method with highest score:

The landfill is assigned a value of 3.

Ref: #4, p. 17

4 WASTE CHARACTERISTICS

Toxicity and Persistence

Compound(s) evaluated:

The only three compounds detected in the site inspection samples are carbon disulfide and iron which can be naturally occurring in this particular area, and lead which may be attributable to a trucking company adjacent to the stream sampled.

Ref: #2, p. 5, 20, Sheet #13
#1, #17, #18

Compound with highest score:

No compounds count. Therefore score is "0".

Ref: #7, p. 17, 18

Hazardous Waste Quantity

Total quantity of hazardous substances at the facility, excluding those with a containment score of 0 (Give a reasonable estimate even if quantity is above maximum):

An unknown quantity of hazardous substances may exist at the Lakewood Township Landfill. An unconfirmed report claims drums of chemicals were disposed on site.

Ref: #13

Basis of estimating and/or computing waste quantity:

Landfill was closed before strict regulatory laws were passed. As a result knowledge of waste received is limited.

Ref: #13

5 TARGETS

Groundwater Use

Use(s) of aquifer(s) of concern within a 3-mile radius of the facility:

Nearby private wells supply residential drinking water and a major municipal well is less than a mile from the site. All these wells tap the Cohansey aquifer. Beyond one mile are several more municipal wells but they tap the much deeper Raritan-Magothy and Englishtown aquifers.

Ref: #10, #11, #12, #13, #14

Distance to Nearest Well

Location of nearest well drawing from aquifer of concern or occupied building not served by a public water supply:

The residences west of the site utilize private well water. The closest residence with a well is Mr. Kloepper on the corner of E. Spruce Street and New Hampshire Avenue.

Ref: #7

Distance to above well or building:

Mr. Kloepper's well is 0.10 miles from the fill area.

Ref: #5

Population Served by Groundwater Wells Within a 3-Mile Radius

Identified water-supply well(s) drawing from aquifer(s) of concern within a 3-mile radius and populations served by each:

The closest wells to the site which use the Cohansey aquifer are several private wells in a development west of the site. These wells range from 35 to 50 feet in depth. The most significant well tapping the Cohansey within three miles is a municipal supply well north of the site. This well is approximately three quarters of a mile away and is 80' deep. This well is owned by the South Lakewood Water Company. This well is part of an integrated system which serves a little over 10,000 people. A total of 38,000 people in the area use groundwater. However many of these people obtain water from deeper aquifers, therefore only the previously mentioned 10,000 + count in scoring.

Ref: #10, #11, #12, #13, #14

Computation of land area irrigated by supply well(s) drawing from aquifer(s) of concern within a 3-mile radius, and conversion to population (1.5 people per acre).

No farms in the area use wells for irrigation.

Ref: #15

Total population served by groundwater within a 3-mile radius:

Over 10,000 people are served by wells tapping the Cohansey aquifer.

Ref: #12

SURFACE WATER ROUTE

1 OBSERVED RELEASE

Contaminants detected in surface water at the facility or downhill from it (5 maximum):

No observed release is scored as no upgradient and downgradient samples were taken.

Ref: #7

Rationale for attributing the contaminants to the facility:

N/A

* * *

2 ROUTE CHARACTERISTICS

Facility Slope and Intervening Terrain

Average slope of facility in percent:

0 to 1% average slope. This slope is based on slope of ground surface surrounding the fll area.

Ref: #7

Name/description of nearest downslope surface water:

Two streams originating on site enter the Cedar Bridge Branch Creek. This creek flows east to the Metedecank River three miles away. This river enters Barneget Bay seven miles away. A cranberry bog was formerly on the Cedar Bridge Branch Creek, however it has been removed for fear of contamination. The creek is still bordered by extensive freshwater marshes. Surface water is not used within three miles downstream of the site. Beyond three miles the water is used for recreational purposes.

Ref: #5, #7, #15

Average slope of terrain between facility and above-cited surface water body in percent:

0 to 1% average slope.

Ref: #5

Is the facility located either totally or partially in surface water?

Yes, two streams feeding the Cedar Bridge Branch Creek are located on the Lakewood Township Landfill property.

Ref: #5

Is the facility completely surrounded by areas of higher elevation?

Area is relatively flat with only a 1% or less slope to the east.

Ref: #5

1-Year 24-Hour Rainfall in Inches

2.75 inches

Ref: #4

Distance to Nearest Downslope Surface Water

On site

Ref: #5, #7

Physical State of Waste

Solid

Ref: #13

* * *

3 CONTAINMENT

Containment

Method(s) of waste or leachate containment evaluated:

Landfill with no cap. Permeable soil. No run-off control.

Ref: #13

Method with highest score:

The landfill is assigned a value of 3.

Ref: #4

4 WASTE CHARACTERISTICS

Toxicity and Persistence

Compound(s) evaluated

The only three compounds detected in the site inspection samples are carbon disulfide and iron which can be naturally occurring in this particular area and lead which may be attributable to a trucking company adjacent to the stream sampled.

Ref: #2, p. 5, 20, Sheet #13
#1, #16, #17, #18

Compound with highest score:

No compounds are attributable to the site. Therefore, score is "0".

Ref: #4, p. 17, 18

Hazardous Waste Quantity

Total quantity of hazardous substances at the facility, excluding those with a containment score of 0 (Give a reasonable estimate even if quantity is above maximum):

An unknown quantity of hazardous substances may exist at the Lakewood Township Landfill. There is an unsubstantiated claim of chemical drum disposal on the site.

Ref: #13

Basis of estimating and/or computing waste quantity:

Landfill was closed before strict regulatory laws were passed. As a result waste quantity and type is not accurately known.

Ref: #13

* * *

5 TARGETS

Surface Water Use

Use(s) of surface water within 3 miles downstream of the hazardous substance:

Surface water is used for recreation only, and recreational use is beyond three miles downstream of the site.

Ref: #5

Ref: #7

Is there tidal influence?

No tidal influence within three miles. Tidal influence is between three and four miles.

Ref: #5

Distance to a Sensitive Environment

Distance to 5-acre (minimum) coastal wetland, if 2 miles or less:

None within two miles.

Ref: #5

Distance to 5-acre (minimum) fresh-water wetland, if 1 mile or less:

Less than a tenth of a mile.

Ref: #5

Distance to critical habitat of an endangered species or national wildlife refuge, if 1 mile or less:

None according to an New Jersey Department of Environmental Protection report.

Ref: #3

Population Served by Surface Water

Location(s) of water-supply intake(s) within 3 miles (free-flowing bodies) or 1 mile (static water bodies) downstream of the hazardous substance and population served by each intake:

There are no water supply intakes within 3 miles of the site.

Ref: #7, #8, #11, #13

Computation of land area irrigated by above-cited intake(s) and conversion to population (1.5 people per acre):

N/A

Total population served:

0

Ref: #8

Name/description of nearest of above water bodies:

N/A

Distance to above-cited intakes, measured in stream miles.

N/A

AIR ROUTE

1 OBSERVED RELEASE

Contaminants detected:

No contaminants were detected by air monitoring instruments during the site inspection. Therefore this route is scored "0".

Ref: #7

Date and location of detection of contaminants

N/A

Methods used to detect the contaminants:

N/A

Rationale for attributing the contaminants to the site:

N/A

* * *

2 WASTE CHARACTERISTICS

Reactivity and Incompatibility

Most reactive compound:

N/A

Most incompatible pair of compounds:

N/A

Toxicity

Most toxic compound:

N/A

Hazardous Waste Quantity

Total quantity of hazardous waste:

N/A

Basis of estimating and/or computing waste quantity:

N/A

* * *

3 TARGETS

Population Within 4-Mile Radius

Circle radius used, give population, and indicate how determined:

0 to 4 mi **0 to 1 mi** **0 to 1/2 mi** **0 to 1/4 mi**

N/A

Distance to a Sensitive Environment

Distance to 5-acre (minimum) coastal wetland, if 2 miles or less:

N/A

Distance to 5-acre (minimum) fresh-water wetland, if 1 mile or less:

N/A

Distance to critical habitat of an endangered species, if 1 mile or less:

N/A

Land Use

Distance to commercial/industrial area, if 1 mile or less:

N/A

Distance to national or state park, forest, or wildlife reserve, if 2 miles or less:

N/A

Distance to residential area, if 2 miles or less:

N/A

Distance to agricultural land in production within past 5 years, if 1 mile or less:

N/A

Distance to prime agricultural land in production within past 5 years, if 2 miles or less:

N/A

Is a historic or landmark site (National Register or Historic Places and National Natural Landmarks) within the view of the site?

N/A

FIRE AND EXPLOSION

1 CONTAINMENT

Hazardous substances present:

Route is not scored as local fire marshall and site inspection by NUS found no imminent fire hazard.

Ref: #1, #7

Type of containment, if applicable:

N/A

* * *

2 WASTE CHARACTERISTICS

Direct Evidence

Type of instrument and measurements:

N/A

Ignitability

Compound used:

N/A

Reactivity

Most reactive compound:

N/A

Incompatibility

Most incompatible pair of compounds:

N/A

Hazardous Waste Quantity

Total quantity of hazardous substances at the facility:

N/A

Basis of estimating and/or computing waste quantity:

N/A

* * *

3 TARGETS

Distance to Nearest Population

N/A

Distance to Nearest Building

N/A

Distance to Sensitive Environment

Distance to wetlands:

N/A

Distance to critical habitat:

N/A

Land Use

Distance to commercial/industrial area, if 1 mile or less:

N/A

Distance to national or state park, forest, or wildlife reserve, if 2 miles or less:
N/A

Distance to residential area, if 2 miles or less:
N/A

Distance to agricultural land in production within past 5 years, if 1 mile or less:
N/A

Distance to prime agricultural land in production within past 5 years, if 2 miles or less:
N/A

Is a historic or landmark site (National Register or Historic Places and National Natural Landmarks) within the view of the site?
N/A

Population Within 2-Mile Radius
N/A

Buildings Within 2-Mile Radius
N/A

DIRECT CONTACT

1 OBSERVED INCIDENT

Date, location, and pertinent details of incident:

Not observed.

Ref: #7

* * *

2 ACCESSIBILITY

Describe type of barrier(s):

No barriers, natural or man-made.

Ref: #7

* * *

3 CONTAINMENT

Type of containment, if applicable:

No liner.

Permeable soil.

No run-off control.

Ref: #13

* * *

4 WASTE CHARACTERISTICS

Toxicity

Compounds evaluated:

The only three compounds detected in the site inspection samples are carbon disulfide and iron which can be naturally occurring in this particular area and lead which may be attributable to a trucking company adjacent to the stream sampled.

Ref: #2, p. 5, 20, Sheet #13

#7, #16, #17, #18

Compound with highest score:

None attributable to site. Therefore score is 0.

Ref: #4, p. 17, 18

5 TARGETS

Population Within One-Mile Radius

1600

Ref: #9

Distance to Critical Habitat (of Endangered Species)

No endangered species within vicinity of the site.

Ref: #3

SECTION 5

HAZARDOUS RANKING SYSTEM SCORING FORMS

Facility name: Lakewood Township Landfill

Location: New Hampshire Avenue, Lakewood, New Jersey

EPA Region: Region II

Persons(s) in charge of the facility: Mr. G. Carlson, Superintendent
Department of Public Works
Lakewood Township, New Jersey

Name of Reviewer: Pamela Kaneta/Daniel Caramagno **Date:** November 29, 1984

General description of the facility:
(For example: landfill surface impoundment pile, container; types of hazardous substances; location of the facility; contamination route of major concern; type of information needed for rating; agency action, etc.)

The Lakewood Township Landfill is currently inactive except for a small leaf and brush composting operation. It is owned and operated by Lakewood Township and occupies approximately 60 acres of an industrial park. The landfill began operation in 1965 and has been closed since 1968. A large number of chemical drums were allegedly disposed on the site in the late 1960's and early 1970's.

The topography is generally flat with a slight slope towards the east to Barnaget Bay seven miles away. Two on site streams form the Cedar Bridge Branch Creek which flows into the Metedecank River which in turn flows to Barneget Bay. West of the site is a residential development. The area immediately surrounding the site to the north, east, and south is industrial.

West of the site are several private wells. A shallow municipal well is less than a mile north of the site. Surface water consists of on-site streams which flow east to Barnagat Bay. Water is used for recreation beyond three miles.

On-site samples obtained during a site inspection contained iron, lead and carbon disulfide. None of these substances are readily attributable to the site.

The Town of Lakewood is currently planning to install monitoring wells as requested by the state Department of Environmental Protection.

Score: S_M = 1.48 (S_{gw} = 2.56 S_{sw} = 0.17 S_a = 0)

S_{FE} = Not scored

S_{DC} = 0

HRS COVER SHEET

Ground Water Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Release	(0) 45	1	0	45	3.1
If observed release is given a score of 45, proceed to line 4. If observed release is given a score of 0, proceed to line 2.					
2 Route Characteristics					3.2
Depth to Aquifer of Concern	0 1 (2) 3	2	4	6	
Net Precipitation	0 1 (2) 3	1	2	3	
Permeability of the Unsaturated Zone	0 1 2 (3)	1	3	3	
Physical State	0 (1) 2 3	1	1	3	
Total Route Characteristics Score			10	15	
3 Containment	0 1 2 (3)	1	3	3	3.3
4 Waste Characteristics					3.4
Toxicity/Persistence	(0) 3 6 9 12 15 18	1	0	18	
Hazardous Waste Quantity	0 (1) 2 3 4 5 6 7 8	1	1	8	
Total Waste Characteristics Score			1	26	
5 Targets					3.5
Ground Water Use	0 1 2 (3)	3	9	9	
Distance to Nearest Well/Population Served	0 4 6 8 10 / 12 16 18 20 / 24 30 32 35 (40)	1	40	40	
Total Targets Score			49	49	
6 If line 1 is 45, multiply 1 x 4 x 5 / If line 1 is 0, multiply 2 x 3 x 4 x 5			1470	57,330	
7 Divide line 6 by 57,330 and multiply by 100			S_{gw} = 2.56		

FIGURE 2
GROUND WATER ROUTE WORK SHEET

Surface Water Route Work Sheet

Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Release	(0) 45	1	0	45	4.1
If observed release is given a value of 45, proceed to line 4. If observed release is given a value of 0, proceed to line 2.					
2 Route Characteristics					4.2
Facility Slope and Intervening Terrain	(0) 1 2 3	1	0	3	
1-yr. 24-hr. Rainfall	0 1 (2) 3	1	2	3	
Distance to Nearest Surface Water	0 1 2 (3)	2	6	6	
Physical State	0 (1) 2 3	1	1	3	
Total Route Characteristics Score			9	15	
3 Containment	0 1 2 (3)	1	3	3	4.3
4 Waste Characteristics					4.4
Toxicity/Persistence	(0) 3 6 9 12 15 18	1	0	18	
Hazardous Waste Quantity	0 (1) 2 3 4 5 6 7 8	1	1	8	
Total Waste Characteristics Score			1	26	
5 Targets					4.5
Surface Water Use	(0) 1 2 3	3	0	9	
Distance to a Sensitive Environment	0 1 (2) 3	2	4	6	
Population Served/Distance to Water Intake Downstream	(0) 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
Total Targets Score			4	55	
6 If line 1 is 45, multiply 1 x 4 x 5. If line 1 is 0, multiply 2 x 3 x 4 x 5			108	64,350	
7 Divide line 6 by 64,350 and multiply by 100			S_{sw} = 0.17		

FIGURE 7
SURFACE WATER ROUTE WORK SHEET

Air Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Release	(0) 45	1	0	45	5.1
Date and Location:					
Sampling Protocol:					
If line 1 is 0, the S_a = 0. Enter on line 5. If line 1 is 45, then proceed to line 2.					
2 Waste Characteristics					5.2
Reactivity and Incompatibility	0 1 2 3	1		3	
Toxicity	0 1 2 3	3		9	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			20	
3 Targets					5.3
Population Within 4-Mile Radius	0 9 12 15 18 21 24 27 30	1		30	
Distance to Sensitive Environment	0 1 2 3	2		6	
Land Use	0 1 2 3	1		3	
	Total Targets Score			39	
4 Multiply 1 x 2 x 3				35,100	
5 Divide line 4 by 35,100 and multiply by 100		S_a = 0			

FIGURE 9
AIR ROUTE WORK SHEET

	S	S^2
Groundwater Route Score (S_{gw})	2.56	6.55
Surface Water Route Score (S_{sw})	0.17	.03
Air Route Score (S_a)	0	0
$S_{gw}^2 + S_{sw}^2 + S_a^2$		6.58
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$		2.57
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} / 1.73 = S_M =$		1.48

FIGURE 10
WORKSHEET FOR COMPUTING S_M

Fire and Explosion Work Sheet

Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Containment	1 3	1		3	7.1
2 Waste Characteristics					7.2
Direct Evidence	0 3	1		3	
Ignitability	0 1 2 3	1		3	
Reactivity	0 1 2 3	1		3	
Incompatibility	0 1 2 3	1		3	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
Total Waste Characteristics Score				20	
3 Targets					7.3
Distance to Nearest Population	0 1 2 3 4 5	1		5	
Distance to Nearest Building	0 1 2 3	1		3	
Distance to Sensitive Environment	0 1 2 3	1		3	
Land Use	0 1 2 3	1		3	
Population Within 2-Mile Radius	0 1 2 3 4 5	1		5	
Buildings Within 2-Mile Radius	0 1 2 3 4 5	1		5	
Total Targets Score				24	
4 Multiply 1 x 2 x 3				1,440	
5 Divide line 4 by 1,440 and multiply by 100		S_{FE} = 0			

FIGURE 11
FIRE AND EXPLOSION WORK SHEET

Direct Contact Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Incident	(0) 45	1	0	45	8.1
If line 1 is 45, proceed to line 4 If line 1 is 0, proceed to line 2					
2 Accessibility	0 1 2 (3)	1	3	3	8.2
3 Containment	0 (15)	1	15	15	8.3
4 Waste Characteristics Toxicity	(0) 1 2 3	5	0	15	8.4
5 Targets					8.5
Population Within a 1-Mile Radius	0 1 2 (3) 4 5	4	12	20	
Distance to a Critical Habitat	(0) 1 2 3	4	0	12	
Total Targets Score			12	32	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5			0	21,600	
7 Divide line 6 by 21,600 and multiply by 100			S_{DC} = 0		

FIGURE 12
DIRECT CONTACT WORK SHEET

SECTION 6

BIBLIOGRAPHY OF INFORMATION SOURCES

BIBLIOGRAPHY OF INFORMATION SOURCES

HRS MODEL

	SOURCE	LOCATION
1.	Telecon between John Padell of Town of Lakewood and Daniel Caramagno of NUS Corporation.	NUS Corp. Region II FIT Office.
2.	Soil Conservation Service, Soil Survey of Ocean County, New Jersey, United States Department of Agriculture, April 1980.	NUS Corp. Region II FIT Office.
3.	"Endangered and Nongame Species Research and Management in 1984", NJ Department of Protection, 1984.	NUS Corp. Region II FIT Office.
4.	Barrett, D. W., et al., Uncontrolled Hazardous Waste Site Ranking System, A User's Manual., Mitre Corporation, April 1982.	NUS Corp. Region II FIT Office.
5.	Topographic Map, Lakewood, New Jersey Quadrangle, 7.5 Minute Series, United States Department of Interior, Geological Survey, 1971.	NUS Corp. Region II FIT Office.
6.	Anderson, H. R. and C. A. Appel. Geology and Groundwater Resources of Ocean County, New Jersey. Department of Conservation and Economic Development, Division of Water Policy and Supply, 1969.	NUS Corp. Region II FIT Office.
7.	Site Inspection, Lakewood Township Landfill, Lakewood, New Jersey. TDD# 02-8403-109A, August 29, 1984.	NUS Corp. Region II FIT Office.
8.	Department of Environmental Protection, Topographic Series-Sheet 29, Division of Water Resources, Bureau of Geology and Topography, 1972. Water Supply Overlay Map - Sheet 29, August 1979.	NUS Corp. Region II FIT Office.
9.	Graphical Exposure Modeling System, Master Area Reference File 1980 Census Data, prepared by General Software Corp. for the United States Environmental Protection Agency, Office of Toxic Substances, Exposure Evaluation Division	NUS Corp. Region II FIT Office.
10.	Telecon between Mr. Chiappetta of NJ Water Company and Daniel Caramagno of NUS Corporation 7/2/86.	NUS Corp. Region II FIT Office.
11.	Telecon between Mr. Hunnewell of NJDEP and Daniel Caramagno of NUS Corporation 7/1/86.	NUS Corp. Region II FIT Office.
12.	Telecon between Mr. Shaiman of South Lakewood Water and Daniel Caramagno of NUS Corporation 7/2/86.	NUS Corp. Region II FIT Office.

BIBLIOGRAPHY OF INFORMATION SOURCES (CONT'D)

HRS MODEL

	SOURCE	LOCATION
13.	Telecon between Mr. Hayton of New Jersey Department of Environmental Protection and Daniel Caramagno of NUS Corporation. 7/2/86	NUS Corp. Region II FIT Office
14.	Telecon beween Mr. Laffety of New Jersey Department of Enviromental Protection and Jerry Cirilli of NUS Corporation 6/1/84.	NUS Corp. Region II FIT Office
15.	Telecon between Shirley Dabnik of the Ocean County Agricultural Service and Daniel Caramagno of NUS Corporation. 7/1/86	NUS Corp. Region II FIT Office
16.	US EPA Contract Laboratory Sample Management Office. Inorganic Analytical Results of samples collected on 8/29/86 by NUS Corp. Region II FIT.	NUS Corp. Region II FIT Office
17.	US EPA Contract Laboratory Sample Management Office. Organic Analytical Results of samples collected on 8/29/86 by NUS Corp. Region II FIT	NUS Corp. Region II FIT Office
18.	H Bohn, "Evaluation of Inorganics in Soil/Sediment", Soil Chemistry, 1979.	NUS Corp. Region II FIT Office

SECTION 7

PRESS RELEASE SUMMARY–MITRE HAZARDOUS RANKING SYSTEM

SUMMARY STATEMENT
LAKEWOOD TOWNSHIP LANDFILL
LAKEWOOD, NEW JERSEY

The Lakewood Township Landfill is a municipal landfill which operated between 1955 and 1968. The landfill occupies 60 acres southeast of the Town of Lakewood, in Ocean County, New Jersey. The landfill is in an industrial park and a composting operation currently exists on site. Drums of chemicals were allegedly dumped on site though this has not been confirmed.

The topography is generally flat with a slight easterly slope towards Barnagat Bay seven miles away. Two on site streams form the Cedar Bridge Branch Creek which flows into the Metedeconk River. This river in turn flows into Barnaget Bay. West of the site is a residential development. The area immediately surrounding the site to the north, east, and south is industrial.

Of primary concern is the shallow aquifer beneath the site. This aquifer is tapped by several private wells adjacent to the site in the west and by municipal well less than a mile north of the site. There are several more municipal wells, within 3 miles of the site, however, these wells tap much deeper aquifers. On site are two streams which flow east into freshwater wetlands and the Cedar Bridge Branch Creek. This water eventually enters Barnegat Bay seven miles away. No use of the surface water occurs within three miles. Beyond three miles there is extensive recreational use.

Two groundwater, two surface water, two soil and two sediment samples were obtained in 1984 during a site inspection. Iron, lead and carbon disulfide were found in various samples. However these contaminants can not be attributed to the site.

The Town of Lakewood is currently planning to install montoring wells as requested by the state Department of Environmental Protection.

SECTION 8

ATTACHMENTS- CITED DOCUMENTS

REFERENCE #1

NUS CORPORATION — **TELECON NOTE**

CONTROL NO:	DATE:	TIME:
02-	7/2/86	1400

DISTRIBUTION:

BETWEEN:	OF:	PHONE:
John Padell	Lakewood Fire Inspector	(364+3760

AND: Daniel Caramagno (NUS)

DISCUSSION:

Landfill is not a fire hazard. Vehicles on site were set on fire by arsons but vehicles were long since removed. No current hazard exists

ACTION ITEMS:

NUS 067 REVISED 0581

REFERENCE #2

Soil Survey of

OCEAN COUNTY, NEW JERSEY

United States Department of Agriculture, Soil Conservation Service
in cooperation with
New Jersey Agricultural Experiment Station, Cook College, Rutgers, The State University
and the
New Jersey Department of Agriculture, State Soil Conservation Committee

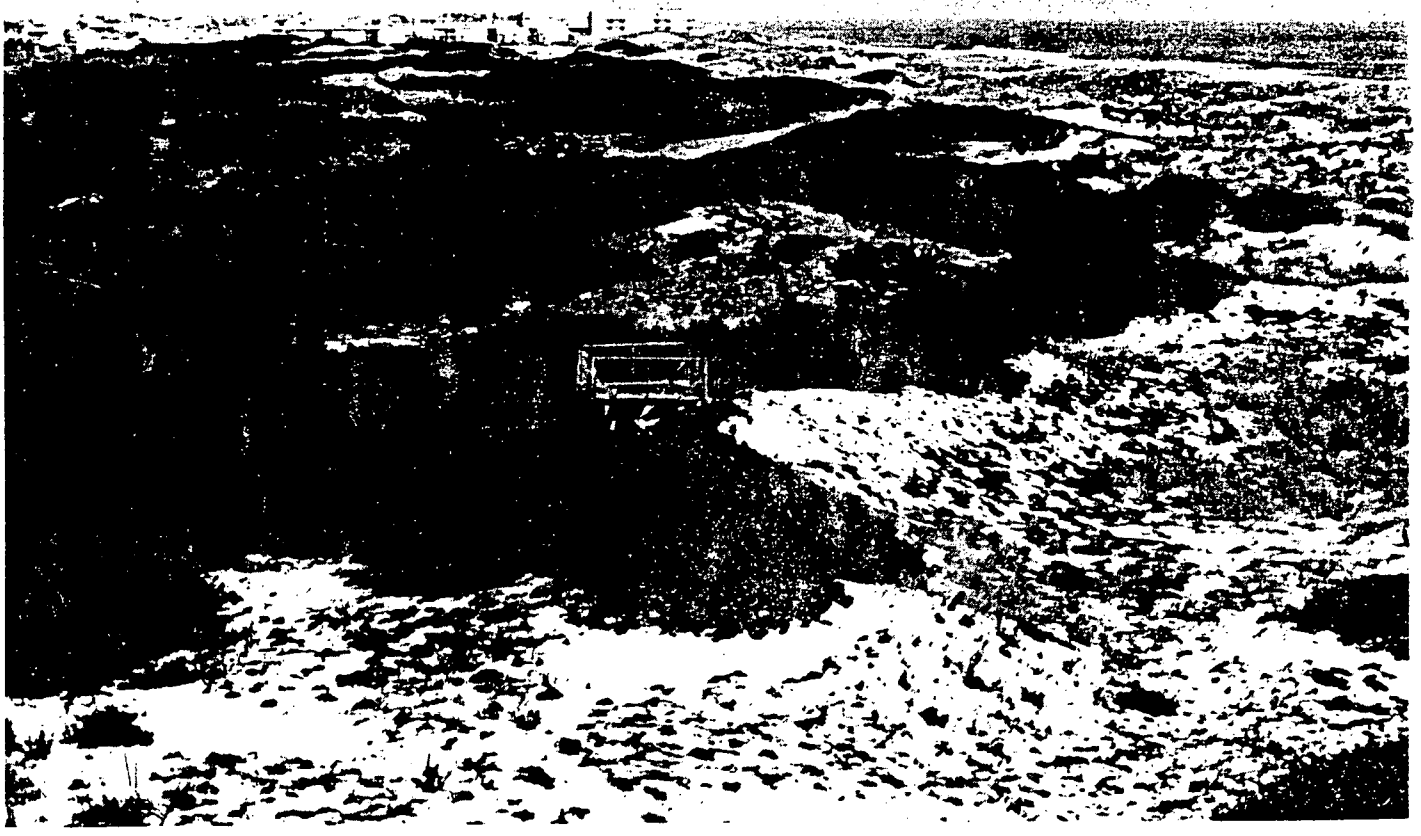


TABLE 1.--TEMPERATURE AND PRECIPITATION DATA

[Data were recorded in the period 1960-75 at Toms River, N.J.]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[1]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	40.9	21.3	31.1	65	-2	28	3.32	2.01	4.48	6	5.3
February---	42.2	22.5	32.4	66	-4	7	3.69	2.45	4.80	6	5.5
March------	50.2	30.0	40.1	78	11	109	3.97	2.54	5.25	6	3.7
April------	61.3	37.9	49.6	89	21	292	3.90	2.13	5.33	7	.1
May--------	71.0	47.9	59.5	93	31	605	3.34	1.58	4.77	6	.0
June-------	80.5	58.0	69.2	97	41	876	3.55	2.27	4.70	6	.0
July-------	84.7	62.6	73.6	97	47	1,042	4.74	2.49	6.57	7	.0
August-----	83.8	61.5	72.7	96	44	1,014	4.38	2.12	6.21	6	.0
September--	77.2	54.9	66.1	94	34	783	4.10	2.27	5.59	5	.0
October----	67.5	42.7	55.1	85	21	468	3.66	1.84	5.14	5	.0
November---	56.6	34.9	45.7	78	16	192	3.56	1.40	5.29	6	.0
December---	44.7	26.2	35.5	68	7	51	4.37	2.35	6.02	6	2.6
Yearly:											
Average--	63.4	41.7	52.6	---	---	---	---	---	---	---	---
Extreme--	---	---	---	98	-4	---	---	---	---	---	---
Total----	---	---	---	---	---	5,467	46.58	40.18	52.70	72	17.2

[1]A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40° F).

TABLE 6.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group
						K	T	
	In	In/hr	In/in	pH				
hA----------	0-12	6.0-20	0.04-0.09	3.6-5.0	Low----------	0.17	5	1
Lakehurst	12-46	6.0-20	0.04-0.10	3.6-5.0	Low----------	0.17		
	46-60	6.0-20	0.04-0.10	4.5-5.0	Low----------	0.17		
mA----------	0-16	6.0-20	0.04-0.07	3.6-5.0	Low----------	0.17	5	1
Lakehurst	16-41	6.0-20	0.04-0.10	3.6-5.0	Low----------	0.17		
	41-60	<0.2	0.10-0.16	4.5-5.0	Moderate------	0.17		
LwB----------	0-10	6.0-20	0.04-0.09	3.6-5.0	Low----------	0.17	5	1
Lakewood	10-36	6.0-20	0.04-0.10	3.6-4.5	Low----------	0.17		
	36-60	2.0->6.0	0.04-0.14	3.6-4.5	----------	0.17		
LwC----------	0-11	6.0-20	0.04-0.09	3.6-5.0	Low----------	0.17	5	1
Lakewood	11-28	6.0-20	0.04-0.10	3.6-4.5	Low----------	0.17		
	28-60	2.0->6.0	0.04-0.14	3.6-4.5	----------	0.17		
ma----------	0-39	0.2-6.0	0.30-0.35	3.6-5.5	High----------	---	---	---
Manahawkin	39-60	2.0-6.0	0.04-0.08	4.5-5.0	Low----------	---		
r----------	0-11	0.6-2.0	0.12-0.20	3.6-4.5	Low----------	0.24	3	---
Mullica	11-25	2.0-6.0	0.06-0.10	3.6-5.0	Low----------	0.20		
	25-60	0.6-6.0	0.06-0.18	3.6-5.0	Low----------	0.28		
Mu----------	0-12	0.6-2.0	0.12-0.20	3.6-4.5	Low----------	0.24	3	---
Mullica	12-25	2.0-6.0	0.06-0.10	3.6-5.0	Low----------	0.20		
	25-60	0.6-6.0	0.06-0.18	3.6-5.0	Low----------	0.28		
PeA----------	0-22	2.0-6.0	0.04-0.10	3.6-5.5	Low----------	0.20	4	1
Pemberton	22-36	2.0-6.0	0.14-0.18	4.5-5.5	Low----------	0.20		
	36-60	2.0-6.0	0.06-0.16	4.5-5.5	Low----------	0.20		
PhB----------	0-6	2.0-6.0	0.07-0.14	3.6-5.0	Low----------	0.28	4	---
Phalanx	6-22	0.6-6.0	0.10-0.14	4.5-5.5	Low----------	0.20		
	22-46	0.6-2.0	0.02-0.14	4.5-5.5	Low----------	0.20		
	46-60	2.0-6.0	0.02-0.14	4.5-5.5	Low----------	0.20		
PhC----------	0-12	2.0-6.0	0.07-0.14	3.6-5.0	Low----------	0.28	4	---
Phalanx	12-26	0.6-6.0	0.10-0.14	4.5-5.5	Low----------	0.20		
	26-42	0.6-2.0	0.02-0.14	4.5-5.5	Low----------	0.20		
	42-60	2.0-6.0	0.02-0.14	4.5-5.5	Low----------	0.20		
Pi*.								
Pits, sand and gravel								
W*, PO*, PW*.								
Psamments								
SaB----------	0-6	0.6-6.0	0.12-0.20	3.6-5.5	Low----------	0.28	4	---
Sassafras	6-41	0.6-2.0	0.11-0.22	3.6-5.5	Low----------	0.43		
	41-60	0.6-20	0.04-0.12	3.6-5.5	Low----------	0.17		
Sh----------	0-10	0.6-2.0	0.18-0.24	3.6-4.4	Low----------	0.28	2	---
Shrewsbury	10-35	0.6-2.0	0.16-0.22	4.5-5.0	Moderate------	0.32		
	35-60	2.0-6.0	0.12-0.18	4.5-5.0	Low----------	0.28		
Su*.								
Sulfaquents.								
Sulfihemists.								
Sk----------	0-25	6.0-20	0.10-0.14	3.6-4.4	Low----------	0.20	4	1
Sloton	25-42	2.0-6.0	0.14-0.18	4.5-5.0	Low----------	0.20		
	42-60	2.0-6.0	0.12-0.16	4.5-5.0	Low----------	0.20		
Ur.								
Urban land								

See footnote at end of table.

example, was named for the town of Lakewood in Ocean County.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Downer sandy loam, 2 to 5 percent slopes, is one of several phases within the Downer series.

Some map units are made up of two or more dominant kinds of soil. Such map units are called soil complexes, soil associations, and undifferentiated groups.

A *soil complex* consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area includes some of each of the two or more dominant soils, and the pattern and proportion are somewhat similar in all areas. Urban land-Fripp complex is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because there is little value in separating them. The pattern and proportion of the soils are not uniform. An area shown on the map has at least one of the dominant (named) soils or may have all of them. Sulfaquents and Sulfihemists is an undifferentiated group in this survey area.

Most map units include small, scattered areas of soils other than those that appear in the name of the map unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the map unit. These soils are described in the description of each map unit. Some of the more unusual or strongly contrasting soils that are included are identified by a special symbol on the soil map.

The acreage and proportionate extent of each map unit are given in table 4, and additional information on properties, limitations, capabilities, and potentials for many soil uses is given for each kind of soil in other tables in this survey. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

Map unit descriptions

AdA—Adelphia fine sandy loam, 0 to 3 percent slopes. This nearly level to gently sloping, moderately well drained and somewhat poorly drained soil is in depressions and on low divides. The areas are irregular in shape and range from about 5 to 50 acres.

Typically, the surface layer is dark grayish brown fine sandy loam about 11 inches thick. The upper part of the subsoil is 11 inches of light olive brown fine sandy loam. The middle part is 6 inches of olive sandy clay loam with strong brown mottles. The lower part is 6 inches of light olive gray sandy clay loam with reddish yellow mottles. The substratum extends to a depth of 60 inches or more. It is olive loamy sand and yellowish brown sandy clay loam with light gray mottles.

Included with this soil in mapping are areas of Collington, Kresson, Pemberton, and Shrewsbury soils. The Collington soils are better drained than this Adelphia soil, and the Kresson soils have a higher content of clay in the subsoil. The Shrewsbury soils are not as well drained as this Adelphia soil and have a darker surface layer, and the Pemberton soils are more sandy. Included soils make up about 10 percent of this map unit.

The permeability of this soil is moderate. Available water capacity is high. The seasonal high water table is 1.5 to 4 feet below the surface. During seasons of normal rainfall, the water table starts to rise in October and is nearest to the surface in early January. It starts to drop in April and is at a depth of 5 feet or more by June. Organic matter content of the soil is moderate, and natural fertility is high. Unless the soil has been limed, the surface layer is extremely acid and the subsoil and substratum are strongly acid to very strongly acid. Runoff is slow. Tilth is good, and the soil is easily worked.

Most of the acreage of this soil is farmed. A few acres are used for pasture, and some are in woodland.

The soil is suited to corn, soybeans, vegetables, small grain, hay, pasture, and commercial sod. It has a slight erosion hazard, which can be controlled by planting cover crops. Tilth and organic matter content can be maintained by planting cover crops and plowing under crop residue. Wetness limits the soil for some crops.

This soil is well suited to pasture. Proper seeding, proper stocking, and rotation of pastures are the major pasture management practices used on the soil.

This soil is well suited to trees. Red oak, black oak, white oak, scarlet oak, hickory, beech, ash, yellow-poplar, and sweetgum generally are the common species, but pin oak and willow oak are common in lower areas and sweetgum dominates abandoned fields.

The seasonal high water table limits this soil as a site for houses with basements and for septic tank absorption fields. It also limits use of the soil as a site for sanitary landfills.

This soil is in capability subclass IIw.

At—Atsion sand. This nearly level, poorly drained soil is in depressional areas and on broad flats. The areas are mainly irregular in shape and range from about 10 to 200 acres. Some areas are long and narrow.

Typically, the surface layer is black sand about 5 inches thick. The subsurface layer is light gray sand 13 inches thick. The subsoil is dark reddish brown loamy sand 6 inches thick. The substratum is light gray sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of Berryland, Lakehurst, Mullica, and Manahawkin soils. The Berryland soils are very poorly drained. The Lakehurst soils

are somewhat poorly drained or moderately well drained. The Mullica soils have more clay in the surface layer and subsoil than this Atsion soil. The Manahawkin soils have 16 to 51 inches of organic material over a sandy substratum. Included soils make up about 15 percent of this map unit.

The permeability of this soil is moderately rapid. If the soil is drained, available water capacity is low, but water is available to plants from the water table. The seasonal high water table is between the surface and a depth of 1 foot from November to June. Some areas have water ponded on the surface. In summer the water table is at a depth of 2 to 3 feet but is as deep as 5 feet in places during extended dry periods. Areas adjacent to perennial streams are subject to rare to occasional flooding. Organic matter content of the soil is moderate, and natural fertility is low. Unless the soil has been limed, the surface layer is extremely acid and the subsoil and substratum are strongly acid to very strongly acid. Runoff is very slow. Tilth is good, and the soil is easily worked when drained.

Most of the acreage of this soil is used for woodland. A few acres are in pasture.

This soil is well suited to such special crops as cranberries and blueberries. Wetness limits most other types of crop production. Land smoothing is needed for blueberries and cranberries. Controlling the level of the water table is needed for blueberry production, and cranberry production requires a carefully designed system of dikes and control of the water table to permit rapid flooding and drainage.

This soil is poorly suited to commercial woodland production. Pitch pine, red maple, blackgum, swamp white oak, sweetgum, and willow oak are the common tree species. The seasonal high water table limits the harvesting of trees during the winter and spring.

The seasonal high water table limits this soil for most urban uses, especially for making excavations.

This soil is in capability subclass Vw.

Aw—Atsion sand, tide flooded. This nearly level, poorly drained soil is in positions in the tidal marsh that are subject to flooding when tides are abnormally high. The areas are irregular in shape and range from about 5 to 130 acres.

Typically, the surface layer is black sand about 6 inches thick. The subsurface layer is light gray sand 7 inches thick. The upper part of the subsoil is 4 inches of black loamy sand. The middle part is 5 inches of light brownish gray sand with yellowish brown mottles. The lower part is 6 inches of dark brown sand. The substratum extends to a depth of 60 inches or more. It is gray sandy loam to a depth of 32 inches and light gray sand at a depth of more than 32 inches.

Included with this soil in mapping are areas of Sulfaquents, Sulfihemists, and Fripp soils. Sulfaquents and Sulfihemists consist of organic material over a sandy substratum. Fripp soils are excessively drained and are on dunes. Included soils make up about 10 percent of this map unit.

The permeability of this soil is moderately rapid. Available water capacity is low. The seasonal high water table is between the surface and a depth of 3 feet. It is at a greater depth in soils at high positions where tidal flooding occurs the least. Organic matter content of the soil is moderate, and natural fertility is low. The soil is very strongly acid or strongly acid throughout. Runoff is very slow.

Most of the acreage of this soil is used for wildlife habitat. The remaining acreage is used for salt hay production, and only grasses and shrubs with some salt tolerance will grow on this soil. The soil is poorly suited to farming, pasture, and woodland production. Tidal flooding and the high water table make the soil poorly suited to urban uses.

This soil is in capability subclass VIIIw.

AxB—Aura sandy loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on divides and side slopes. Slopes are dominantly convex and range from 100 to 300 feet in length. The areas are irregular in shape and range from about 40 to 900 acres.

Typically, the surface layer is grayish brown sandy loam about 3 inches thick. The subsurface layer is yellowish brown sandy loam 13 inches thick. The subsoil is firm, yellowish red sandy clay loam and sandy loam 34 inches thick. The substratum is yellowish red loamy sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of Downer, Woodmansie, and Sassafras soils. The Downer soils have less clay in the subsoil than this Aura soil, and the Sassafras soils do not have the firm subsoil. The Woodmansie soils have a subsurface layer of gray sand. Included soils make up about 20 percent of this map unit.

The permeability of this soil is moderately slow to moderate in the subsoil and moderately slow to moderately rapid in the substratum. Available water capacity is moderate. Organic matter content is moderate, and natural fertility is medium. Unless the soil has been limed, it is extremely acid or very strongly acid. Runoff is medium. Tilth is good, and the soil is easily worked.

Most of the acreage of this soil is used for woodland and wildlife habitat. A few acres are in pasture.

The soil is suited to corn, soybeans, vegetables, small grains, and hay. It has a moderate erosion hazard, which can be controlled by planting cover crops and farming on the contour. Tilth and organic matter content can be maintained by planting cover crops and plowing under crop residue.

This soil is suited to pasture. Proper seeding, proper stocking, and rotation of pastures are the major management practices used on this soil.

The soil is suited to trees. Pitch pine, black oak, scarlet oak, white oak, and chestnut oak are the common

and the subsoil and substratum are very strongly acid. Runoff is slow. Tilth is good, and the soil is easily worked.

Because of very low fertility, low available water capacity, and rapid permeability, this soil is not well suited to cultivated crops. If farmed, the soil needs frequent fertilizer applications. Cover crops and windbreak hedges are needed to control a moderate wind erosion hazard. Tilth and organic matter content can be maintained by planting cover crops and plowing under crop residue.

Although most of the acreage is used for trees, the soil is poorly suited to commercial woodland production. Pitch pine, black oak, white oak, and blackgum are the common species. Trees grow slowly because of low available water capacity during the growing season. Woodlands need protection from wildfires.

The seasonal high water table limits the soil as sites for houses with basements, septic disposal fields, and sanitary landfills. The high sand content limits the soil for most recreational uses.

This soil is in capability subclass IVw.

LmA—Lakehurst sand, clayey substratum, 0 to 3 percent slopes. This nearly level, moderately well drained or somewhat poorly drained soil is in depressed areas and on low terraces. The areas are irregular in shape and range from about 20 to 200 acres.

Typically, the surface layer is dark gray sand about 4 inches thick. The subsurface layer is light gray sand 12 inches thick. The subsoil is 25 inches of dark brown and yellowish brown sand and has light gray mottles in the lower part. The substratum extends to a depth of 60 inches or more. To a depth of 47 inches it is brownish yellow sandy clay loam with light gray mottles. At a depth of more than 47 inches it is light gray sandy clay with brownish yellow mottles.

Included with this soil in mapping are areas of Lakewood and Atsion soils and Lakehurst soils that do not have a clayey substratum. The Lakewood soils are excessively drained, and the Atsion soils are poorly drained. Also included are a few areas of soils where the depth to the substratum is less than 40 inches. Included soils make up about 20 percent of this map unit.

The permeability of this soil is rapid to a depth of about 40 inches and slow at a depth of more than 40 inches. Available water capacity is low, but water is available to plants early in the season from the water table. The seasonal high water table is 1-1/2 to 2-1/2 feet below the surface. During years with normal rainfall, the water table starts to rise in October and is nearest to the surface in January. It starts to drop in April and is at a depth of 3 feet or more by June. The water table is perched over the clayey substratum, and it rises rapidly when rainfall is abnormally heavy. Organic matter content in the soil is low, and natural fertility is very low. Unless the soil has been limed, the surface layer is extremely acid and the subsoil and substratum are very strongly acid or extremely acid. Runoff is slow. Tilth is good, and the soil is easily worked.

Because of the very low fertility, the low available water capacity, and the rapid permeability in the upper 40 inches, this soil is not suited to cultivated crops. Frequent applications of fertilizer are needed on the soil, and cover crops and windbreak hedges are needed to control a moderate wind erosion hazard. Tilth and organic matter content can be maintained by planting cover crops and plowing under crop residue.

Although most of the acreage is used for trees, this soil is poorly suited to commercial woodland production. Pitch pine, black oak, white oak, and black gum are most common species. Trees grow slowly on this soil because of the low available water capacity during the growing season.

The seasonal high water table, the slow permeability of the substratum, and the high content of sand limit this soil for most urban uses.

This soil is in capability subclass IVw.

LwB—Lakewood sand, 0 to 5 percent slopes. This nearly level to gently sloping, excessively drained soil is on divides and side slopes. Slopes are convex and range from 100 to 500 feet in length. The areas are irregular in shape and range from about 10 to 1,500 acres.

Typically, the surface layer is black sand 1 inch thick. The subsurface layer is light brownish gray sand 9 inches thick. The subsoil is yellowish brown sand 26 inches thick. The substratum is brownish yellow sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of Lakehurst soils, more sloping Lakewood sand, Evesboro soils, and Woodmansie soils. The Lakehurst soils are moderately well drained or somewhat poorly drained. The Evesboro soils do not have the distinct light brownish gray subsurface layer typical of this Lakewood soil. The Woodmansie soils have more clay in the subsoil and substratum. Included soils make up about 10 percent of this map unit.

The permeability of this soil is rapid in the subsoil and rapid to moderate in the substratum. Available water capacity is low. Organic matter content is low, and natural fertility is very low. Unless the soil has been limed, the surface layer is extremely acid and the subsoil and substratum are very strongly or extremely acid. Runoff is slow. Tilth is good, and the soil is easily worked.

This soil is poorly suited to crops and pasture because of very low fertility, the low available water capacity, and the rapid permeability in the subsoil. If farmed, the soil must be irrigated and frequently fertilized. Windbreak hedges are needed to control a severe wind erosion hazard. Tilth and organic matter content can be maintained by planting cover crops and plowing under crop residue.

Although most of the acreage is wooded, this soil is poorly suited to commercial trees because of low available water capacity and very low fertility. Pitch pine, blackjack oak, post oak, chestnut oak, black oak, and white oak are the common species. Growth is slow, and the woodland needs protection from wildfires.

The soil is generally suitable for most urban uses, but the loose, sandy surface is a limitation for recreational uses and the rapid permeability limits use for sanitary landfills.

This soil is in capability subclass VIIs.

LwC—Lakewood sand, 5 to 10 percent slopes. This sloping, excessively drained soil is on side slopes. Slopes are convex and range from 50 to 200 feet in length. Most areas are long and narrow and range from about 10 to 400 acres. Some small areas are round or oval.

Typically, the surface layer is very dark grayish brown sand 2 inches thick. The subsurface layer is light gray sand 9 inches thick. The subsoil is yellowish brown sand 17 inches thick. The substratum is brownish yellow sand to a depth of 60 inches or more.

Included with this soil in mapping are areas of less sloping Lakewood sand, sloping and moderately steep Evesboro sand, and sloping Woodmansie sand. Some areas of the Evesboro sand have a thinner subsurface layer than this Lakewood soil, and some do not have a subsurface layer. The Woodmansie soils have more clay in the subsoil than this Lakewood soil. Included soils make up about 10 percent of this map unit.

The permeability of this soil is rapid. Available water capacity is low. Organic matter content is low, and natural fertility is very low. Unless the soil has been limed, the surface layer is extremely acid and the subsoil and substratum are very strongly acid or extremely acid. Runoff is medium. Tilth is good, and the soil is easily worked.

Because of very low fertility, the low available water capacity, and the rapid permeability, this soil is poorly suited to cultivated crops and pasture. The hazard of water erosion is moderate. If farmed, the soil needs irrigation and frequent applications of fertilizer. Tilth and organic matter can be maintained by controlling erosion, planting cover crops, and plowing under crop residue.

Although much of the acreage is wooded, this soil is poorly suited to woodland production. Slow growth is caused by the low available water capacity and very low fertility. Pitch pine, blackjack, post oak, chestnut oak, white oak, and black oak are the common species. The woodlands need protection from wildfires.

The rapid permeability of the soil is a limitation for sanitary landfills.

This soil is in capability subclass VIIs.

Ma—Manahawkin muck. This nearly level, very poorly drained soil is on flood plains adjacent to large streams, is in depressional areas, and is on broad flats. areas are long and narrow and range from about 1,100 acres. Some large areas are oval.

Typically, the surface layer is black muck abou inches thick. The substratum extends to a depth inches or more. It is gray sand to a depth of 43 in and gray gravelly sand at a depth of more tha inches.

Included with this soil in mapping are areas of E land, Atsion, and Mullica soils, none of which has surface layer of muck typical of this Manahawkin Included soils make up about 10 percent of this unit.

The permeability of this soil is moderately slo moderately rapid in the subsoil and moderately rap the substratum. Dry areas of this soil absorb water slowly. Available water capacity is high. A seasonal water table is at the surface from November to J and some areas have water ponded on the surf During the summer, the water table is generally depth of 1 to 2 feet but is as deep as 3 feet in pl during extended dry periods. Areas of this soil are ject to frequent flooding. Organic matter content of soil is high, and natural fertility is low. Unless the soil been limed, the surface layer is extremely acid and subsoil and substratum are strongly acid to very strc acid. Runoff is very slow. This soil is easily worked w drained, and tilth is good, but the soil subsides w drained.

This soil has limited potential for cranberry and b berry production. The areas need protection from fl ing. Some need drainage ditches, and most need to sanded for cranberries. Construction of dikes requ mineral soil material from the uplands.

The soil is suited to trees, though growth is slow. M of the acreage of the soil is used for woodland wildlife habitat. Nearly pure stands of Atlantic wh cedar make up the dominant forest. In some pla where Atlantic white-cedar has been harvested, maple, sweetgum, blackgum, and pitch pine seed in. seasonal high water table, low strength for access roa and flooding limit harvesting of the trees during winter and spring.

This soil is limited for most urban uses by flooding, seasonal high water table, and subsidence of the surf layer.

This soil is in capability subclass VIIw.

Mr—Mullica fine sandy loam, loamy substrat This nearly level, very poorly drained soil is in dep sional areas and on broad flats. The areas are irreg in shape and range from about 50 to 200 acres.

Typically, the surface layer is black fine sandy lo about 11 inches thick. The subsurface layer is very d gray fine sandy loam 6 inches thick. The upper par the subsoil is 8 inches of light brownish gray fine sa loam. The lower part is 5 inches of light brownish g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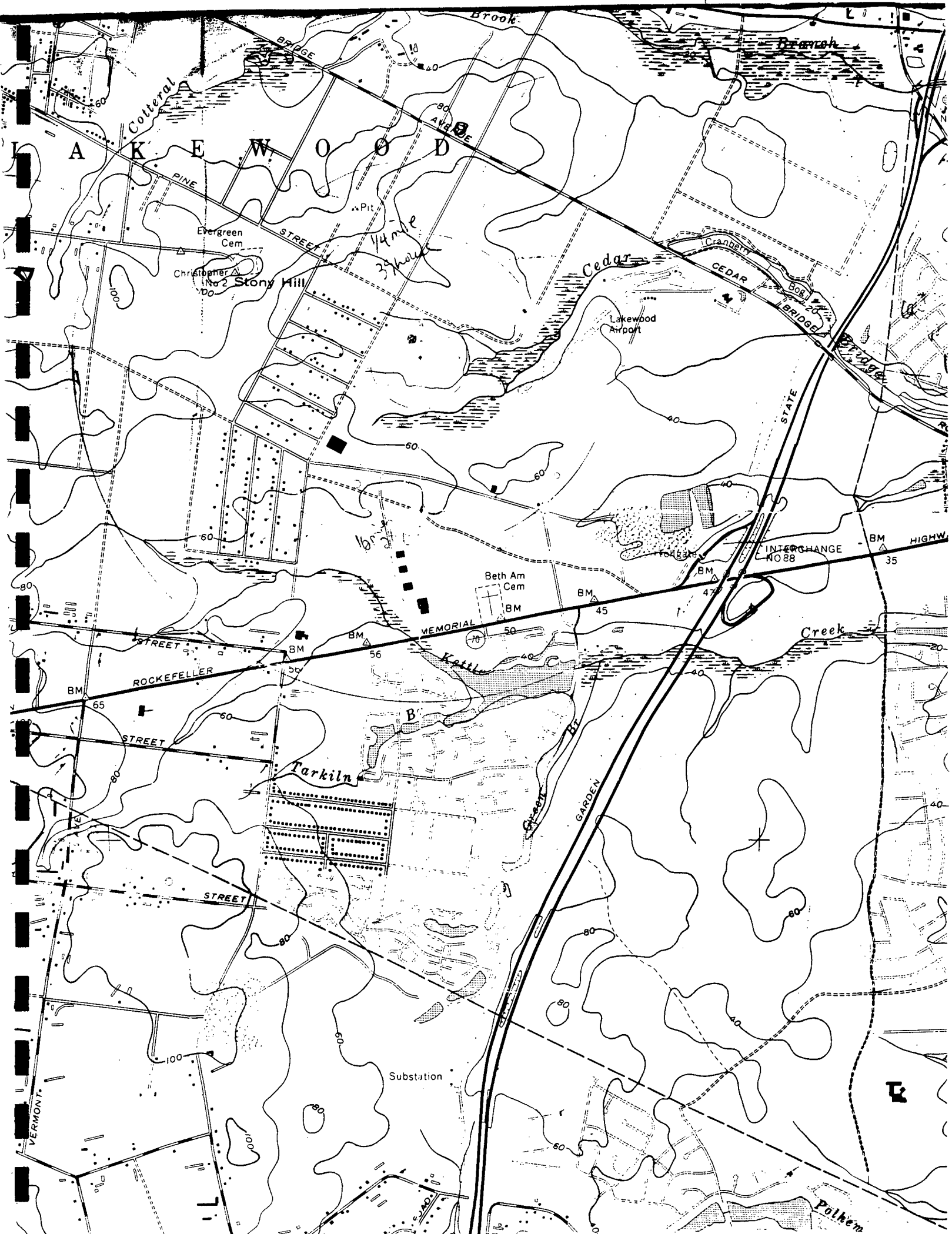
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The Tenth Year!

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Endangered and Nongame Species Research & Management in 1984

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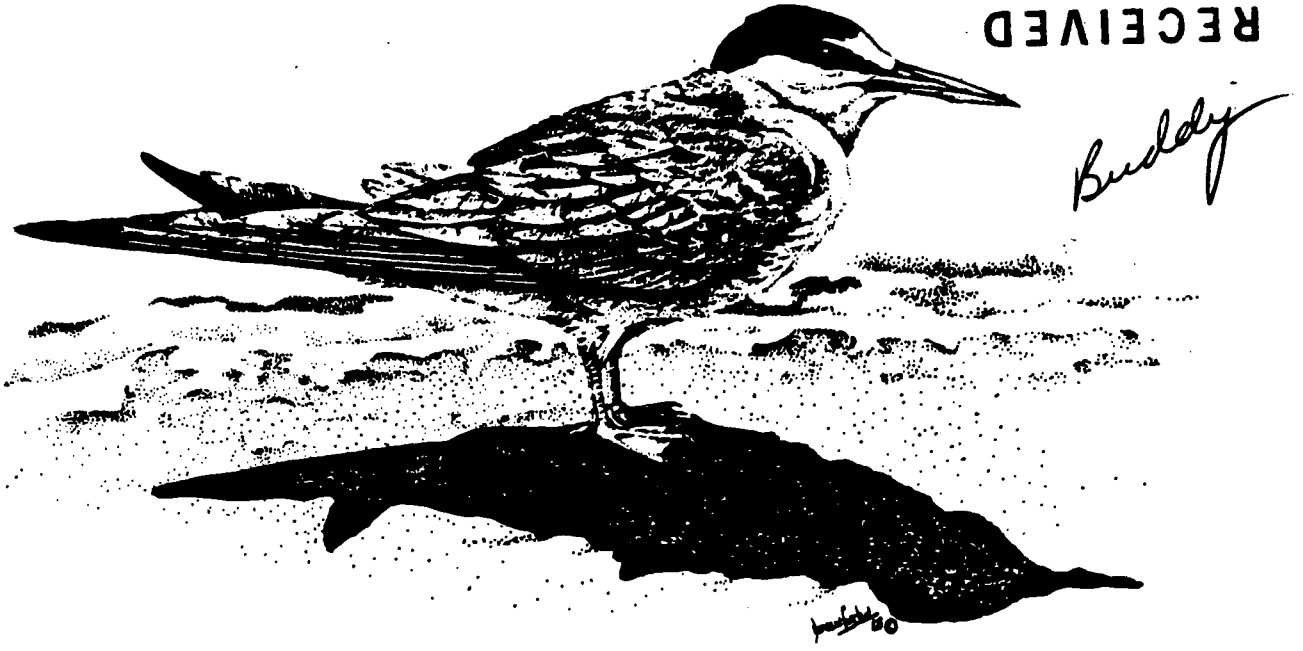

N.J. Department of Environmental Protection

THE TENTH YEAR

Endangered and Nongame Species Research and Management in 1984

compiled by Miriam Dunne
Endangered and Nongame Species Program
Division of Fish, Game and Wildlife
N.J. Department of Environmental Protection

January, 1984

New Jersey Department of Environmental Protection

Division of Fish, Game and Wildlife

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Contents

Tables

Preface

A decade of nongame and endangered species management is celebrated in 1984 in in New Jersey. The Endangered and Nongame Species Program was created within the Division of Fish, Game and Wildlife following the passage of the Endangered Species Act of 1973. Since then, the Program has grown from its initial emphasis on research into applying that research to achieve management objectives. Many of the successes of the fledgling art and science of nongame management can be attributed to the experience of the field of wildlife management in general. New Jersey has certainly benefitted from that wealth of experience.

One of the most radical changes in the wildlife picture in recent years is the increased interest and involvement that the public has demonstrated toward this valuable resource. More and more New Jerseyans are beginning to realize that wildlife and wildlife habitat are linked to their own quality of life. Each year, more people seek to attract wildlife to their environs and take to the field to enjoy wildlife. Increasingly, even in tough economic times, people are supporting wildlife programs through their state income tax form. In New Jersey, the line on the tax form has allowed people to "check-off" for wildlife, generating over $850,000 in two years.

This report is the first of a series of periodic papers summarizing on-going projects and progress. In some cases, projects have been continuing for eight years. In other instances, species are only beginning to be investigated. At one time, manpower was limited to investigation and management of endangered and threatened species only. This year however, projects were undertaken on species with an "undetermined" status. As a result of the income tax check-off, the efforts of the Program are of a wider scope. The projects reported herein are grouped by research, management or protection content.

We always welcome your questions or comments. Through the income tax check-off you make this work possible; you have a say in what is being done.

Miriam Dunne

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Dr. Richard VanGelder

Goals and Objectives of the Endangered and Nongame Species Program

Goals

1. As mandated by the Endangered and Nongame Species Conservation Act of 1973 (N.J.S.A. 23:2A-13 et. seq.) the primary goal of the program shall be to manage wildlife to ensure the "... continued participation in the ecosystem..." of the 600+ species of vertebrate nongame wildlife in New Jersey.

2. To provide for the management, enhancement and protection of nongame species and their habitat.

3. To provide for the development and enhancement of the esthetic, recreational, educational, and economic benefits derived by the general public from the state's diverse nongame wildlife resources.

4. To inform the public of the status, management and needs and regulations of nongame species.

Objectives

1. To promulgate a list of native nongame species, species-habitat associations and statewide species status.

2. To determine the life history, distribution and protection and management needs of the state's principal nongame species.

3. To develop programs of research and management for the principal nongame species to insure their continued participation in the ecosystem.

4. To locate, map, evaluate, and recommend the purchase and/or protection of critical or unique habitat types of significant value to the local or regional nongame wildlife resources.

5. To develop a nongame habitat management plan (including demonstration areas) which can be utilized by township and county conservation commissions, nature centers, schools, park systems and private individuals interested in developing wildlife habitat in their communities.

6. To review current and proposed federal or state legislation and regulations; make recommendations for revisions and new legislation to more effectively and efficiently manage and protect the state's nongame wildlife resources.

7. To provide for cooperation and interaction of other departments, divisions, bureaus and sections within the State government and participation with federal, other states and local governmental agencies.

8. To provide for the environmental impact reviews and to provide direction to those concerned with nongame management programs.

9. To further regulate through a permit system, the taking, possession, and transportation of nongame wildlife for scientific, educational, rehabilitational, and other purposes.

10. To provide factual information relative to nongame wildlife to federal, state, and local governmental agencies upon request.

11. To develop education programs designed to acquaint the public with the presence and importance of nongame wildlife; and to enhance their perceptions and appreciation for, and educational and recreational interactions with the nongame wildlife resource.

Financial Summary

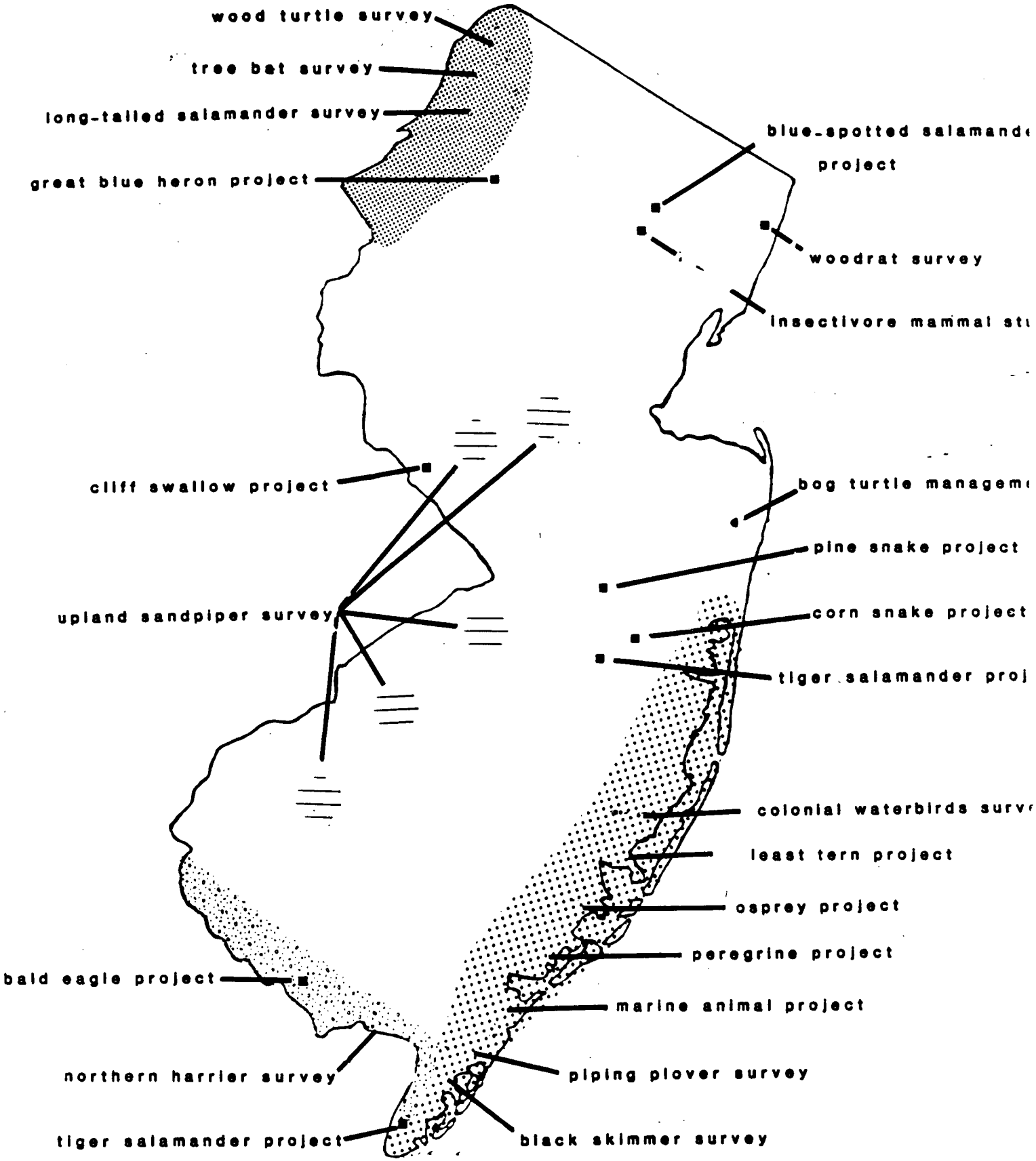
Expenditures

A.	Administrative Overhead	10.5%	$ 50,000
	1) Endangered and Nongame Species Program Administration - Trenton Office		40,000
	2) Bookkeeping		5,000
	3) Director's Office Supervision		5,000
B.	Habitat Protection and Enhancement	12.8%	55,000
	1) EIS review and envir. impact assessment		20,000
	2) Land acquisition and easement acquisition		20,000
	3) Development of urban wildlife program		10,000
	4) Management Plan implementation		5,000
C.	Resource Management	39.5%	170,000
	1) Endangered Species restoration		50,000
	2) Avian investigation		50,000
	3) Herptile investigation		30,000
	4) Mammal investigation		20,000
D.	Services to the Public	32.6%	140,000
	1) Information and education materials		60,000
	2) Promotion		30,000
	3) Regulatory programs, permits		40,000
	4) Extension services		10,000
E.	Education	3.5%	15,000
	1) Education program		15,000
F.	Development of Management of W.M.A.	9.3%	40,000
	1) Nongame input into development of W.M.A. plans		5,000
	2) Higbee Beach W.M.A.		35,000
G.	Overhead	2.2%	10,000
Total			$ 480,000

CAPITAL IMPROVEMENT

Boardwalk - Greenwood Forest W.M.A.	$ 5,000

GENERALIZED LOCATIONS OF SURVEYS AND MANAGEMENT PROJECTS



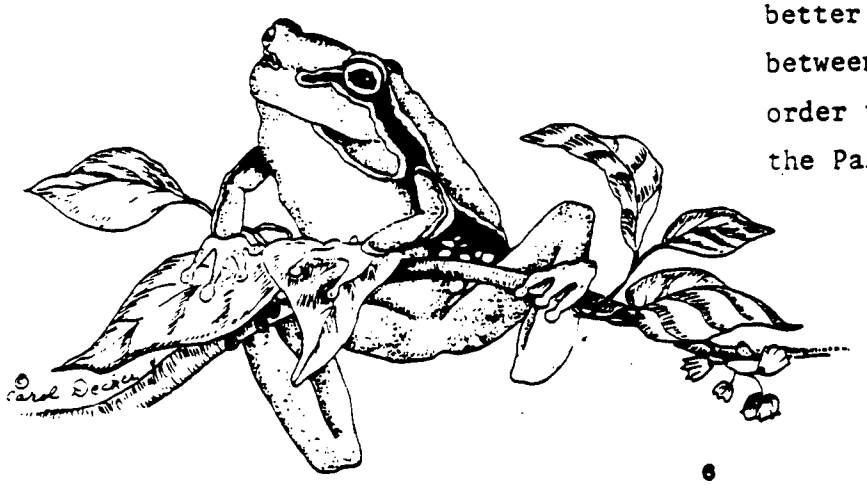
Animal and Habitat Surveys

Reports in this section are summaries of investigations in which basic data needed to manage the populations was collected.

Long-tailed Salamander

Little is known of the distribution and abundance of this threatened salamander historically documented in northern and central New Jersey. In order to update knowledge of distribution, a literature search was conducted by H.A. in 1983 to accompany field searches for the amphibian.

Eighty-one locations of the long-tailed salamander have been identified from historical records and field updates. Wooded uplands with clean springs and seeps, caves and other protected areas are required by the species. Monitoring of known locations continues as more is learned of this salamander. Future work will be conducted to identify new locations and to determine the habitat requirements of this species.



Blue-Spotted Salamander

The blue-spotted salamander and a hybrid of this salamander, the Tremblay's salamander, are two endangered species found within the Passaic River Basin. Intensive development and the loss of habitat has caused the serious decline of this species. Consequently, one of the primary objectives of the research has been to identify critical aquatic breeding habitats and terrestrial habitats to protect these areas.

Herpetological Associates (H.A.) have identified critical areas for these salamanders under research contract in the past, and the search for new breeding locations was continued in 1983. In addition, the habitat parameters of the breeding ponds, and the breeding biology of the blue-spotted and Tremblay's salamander were studied during the past year.

Part of the breeding biology study involved differentiating between the blue-spotted and its hybrid via chromosome count. The Tremblay's is an all-female population that breeds with male blue-spotteds and the resultant offspring are all-female Tremblay's salamanders. A better understanding of the relationship between the two species is needed in order to evaluate the species' status in the Passaic River Basin.

Eastern Timber Rattlesnake

Though the timber rattlesnake continually receives "bad press" and is killed "on the spot" (illegally) for simply being where people are, it lives on in the wilder parts of New Jersey, an element of the last truly "wide open spaces" remaining in the state.

Finding out about the habits and habitat of this endangered animal has been the major objective of an on-going radio-tracking study conducted by H.A. under contract. Up to 10 female timber rattlesnakes will be surgically implanted with AVM instrument Model SMI transmitters in coming years. Two females have been implanted with transmitters to date. With this equipment, tracking the individuals is possible up to 1,000 feet. Data on vegetation type, temperature, rainfall and humidity is correlated to provide a picture of the snake's habitat needs.

The two implanted females from a Pine Barrens population were tracked throughout 23.5 acres. Home ranges included pine-oak forest and white cedar swamps. The snakes were found moving into the swamps in November to hibernate, burrowing around the roots of the white cedar trees.

More individuals from this population will be observed in future radio-tracking studies. Complete information on the snake's habitat needs will allow for greater protection of the species and may lead to habitat management in marginal habitats where populations have declined.

Wood Turtle

Investigations conducted by H.A. under contract have focused on this threatened species from northern and central New Jersey. Information is being collected on this species' habitat requirements in order to formulate a management plan. New colonies are continually being searched out as reliable reports are field-checked.

The population dynamics of a Sussex County colony were monitored from April through November of 1983. Behavior of the turtles, components of their habitat and movements were identified in this study.

There is some indication that openings created in wooded areas by people are beneficial to the wood turtle. A railroad bed near a stream became a nesting site for an aggregation of 20 female wood turtles. Nests averaged 8 eggs apiece. It seems that the turtles use the stream from November - April for hibernating and become terrestrial during the warmer months of the year.

Protection of both the aquatic and terrestrial habitats required by this species is important to its survival. Attempts will be made to identify new populations and appropriate habitat management will be performed where needed

Marine Mammals and Turtles

An on-going project partially funded by Federal monies through the Bureau of Law Enforcement of the Division of Fish, Game and Wildlife involves the collection of data on stranded and dead marine animals. Some of the species are endangered and threatened, others have stable populations.

The Marine Mammal Stranding Center in Atlantic City marshals a network of volunteers to report beached animals. Tissue samples have been taken from marine animal carcasses and analyzed by the Department of Environmental Protection's Office of Science and Research for PCB's and other toxics in the environment.

Following is a composite of stranded marine animals.

SPECIES	YEAR: 1981	1982	1983
Harbor Seal	1	3	2
Common Dolphin	1		
Spotted Dolphin	1		
Striped Dolphin	1	1	1
Pygmy Sperm Whale		3	
Pilot Whale		1	
Humpback Whale		2	
Harbor Porpoise		2	
Antillian Beaked Whale		1	
Right Whale			1
Bottlenose Dolphin			1
Leatherback Turtle	16	2	2
Loggerhead Turtle	5	6	6
Unidentified Turtle	2		
Kemp's Ridley Turtle			2

Colonial Waterbirds

Colonial waterbirds are a group of coastal nesting species that aggregate in single and mixed species groups for breeding purposes. Included in this group are endangered as well as very common and abundant species. The least tern, black skimmer, laughing gull, yellow-crowned night heron and glossy ibis are all examples of colonial waterbirds.

Shrinking habitat for these species has become a major concern in the past several years. An aerial survey was done of the coastal and marsh breeding species in 1977, 78, 79 and again in 1983.

The data are being analyzed for trends in numbers of individuals and colonies. The methods used in counting the colonies and individuals will probably vary in 1984 as better techniques are sought.

Table 1. Four year summary of helicopter counts of colony numbers and adult colonial nesting waterbirds along the Atlantic Coast of New Jersey. 1983, Endangered and Nongame Species Program.

	GE		SN		LB		TR		CE		GI		BC		YC		CT		FT		LT		LG		HG		GBB		BS		GBT	
	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
1977	14	200	23	2440	12	153	9	122	6	410	17	1465	25	681	16	51	44	5492	6	659	16	843	21	30730	32	4316	16	103	10	1994	2	13
1978	17	514	24	2955	14	202	13	150	4	483	23	3756	25	1374	15	99	53	6836	6	693	15	2114	36	41534	36	7635	27	122	11	1905	3	3
1979	15	574	25	3007	13	350	12	193	7	299	25	2027	29	932	15	155	86	9360	18	1492	13	1013	67	53395	53	5832	33	110	14	1803	3	5
1983	17	578	27	1986	18	123	16	134	3	326	22	1011	27	259	13	80	79	6566	24	1624	8	656	79	58264	72	5240	41	213	13	1149	1	2

C = Colonies
A = Adults

GE = great egret
SN = snowy egret
LB = little blue heron
TR = tricolored heron
CE = cattle egret
GI = glossy ibis
BC = black crowned night heron
YC = yellow crowned night heron
CT = common tern
FT = Forster's tern
LT = least tern

LG = laughing gull
HG = herring gull
GBB = great black backed gull
BS = black skimmer
GBT = gull-billed tern

Piping Plover

Concern for the future of this species is increasing all along the Atlantic Coast. This beach nesting species' habitat is destroyed by human development of dunes. People inadvertently destroy piping plover nests by walking on dunes, driving off-road vehicles over dunes and by allowing their dogs and cats to roam free. High tides also flood a proportion of plover nests. New Jersey recognized the critical situation faced by the piping plover and officially added the species to the endangered species list in 1984.

Follow-up studies from 1980 were conducted this year by Anne Galli to assess the species' productivity in Cape May County. The number of active locations declined from 17 in 1980 to 11 in 1983, a loss of 35%. The number of pairs unty-wide declined from 51 in 1980 to 32 in 1983, a loss of 37% and the number of young produced declined from 47 in 1980 to 37 in 1983 for a drop of 21%. It is unclear whether this decline is indicative of a downward population trend or year-to-year variability.

The habitat characteristics of the nesting locations were described this year. Though nesting piping plovers tolerate a wide mixture of sand, grass and shrub, 2/3 of the sites contained at least 50% sand and grass. The shrub cover on the dune sites tended to be below 25% on most of the sites.

In subsequent years, the county's population of piping plovers will be monitored to assess production trends and year-to-year variations. The methods used will be employed on a state-wide survey in future years.

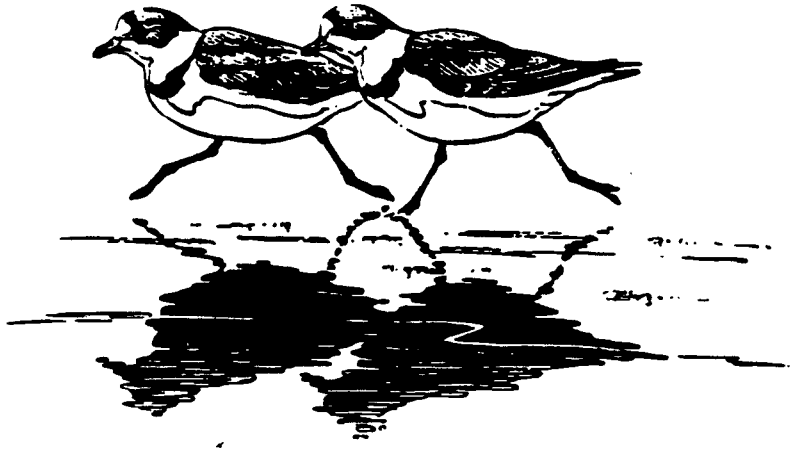


Table 2. Piping Plover Survey 1983 and 1980*.

colony	1983 # pairs	1983 # young	1980 # pairs	1980 # young	disturbance
Avalon, 8th Street	0	0	1/2	0	H,D,F
Avalon Causeway	NC	NC	2-3	0	H
Cape May Canal	0	0	1/2	0	H,D,V
Cape May Ferry	1	0	2	0	H,D,V
Cape May Jetty	.	0	1	1	H,D,F
Cape May Point	0	0	1	0	H,D
Coast Guard Base	1	2-3	3	0	F
Electronics Base	2	1	3	0	H,D,F
Two Mile Beach	0	0	2-5	0	H,D,V,F
Magnasite I	1	0	2	1	P,D
Magnasite II	1	0	1	0	H
Ocean City, 42nd Street	0	0	1	0	H,D
Ocean City, Waverly Beach	NC	NC	2	3	H,D
Ocean Crest State Park N	3-5	4	6	7	H,F
Ocean Crest State Park S	3-6	7	5-6	4	H,D,F
South Cape May Meadow	1	3	1	3	D,F,H
Seven Mile Beach[1]	4	7-8	7-8	10	H,F,V
Stone Harbor Point	5	2	5	3	D,H,F
Whale Beach[2]	8-10	10	10	18	D,H
Totals	30-34	36-39	54-56	50	
	(32)	(37)	(55)	(50)	
young/pairs	1.15		.9		
# sites censused	17		19		
# sites censused showing activity	11		19		
# sites abandoned	3				

NC= Not counted

H = human disturbance
V = vehicles
P = predation
D = dogs
F = flooding

1 = Same as Avalon Dunes, 43rd to 65th street included for both 1980 and 1983.
2 = 1980 figures adjusted to only include 11th to 26th street data. Total number of pairs in 1980 for entire location was 15; number of young, 22.

*from Galli, Anne. 1983. Population Parameters and Habitat Characteristics of Breeding Piping Plovers in Cape May County, N.J. Report submitted to the Endangered and Nongame Species Program.

Upland Sandpiper

A native of midwestern prairies, the upland sandpiper increased its range into the northeast as forests were replaced by farms. Development of open land and reversion of farmland to forest eliminated much of the habitat needed by the species for nesting. The species has declined perilously in recent years warranting inclusion this year on the endangered list.

Surveys of grassland nesting birds, including the upland sandpiper, were done in 1981 and 1982. In 1983, specific information was obtained on the upland sandpiper by Peter Plage working under contract for the Endangered and Nongame Species Program. Breeding habitat requirements, reproductive success and the extent of its utilization of various habitat types was learned.

Six sites located in Salem, Gloucester, Burlington, Hunterdon and Somerset Counties were chosen for intensive field investigation from April through July of 1983. Birds were located, their behavior noted and "boundaries of use" areas were defined. Cover type characteristics were described for the immediate use areas and for the habitat surrounding the primary use area.

Open agricultural land and extensive lawn areas provide habitat for the upland sandpiper. The birds seem to prefer to nest in hay fields and lightly-grazed pastures in addition to fallow fields and grass lawns. Extensive open areas are used by the species, 200 acres on the average and in some cases over 500 acres.

The location of similar extensive open areas for management of grassland nesting species like the upland sandpiper is scheduled for future years. Two years worth of data will be collected to ensure the reliability of the data. This information will then be used to manage the state's upland sandpipers. Ensuring the survival of this insect-eating bird will ultimately depend upon informed landowners since most sandpiper habitat occurs on private land.

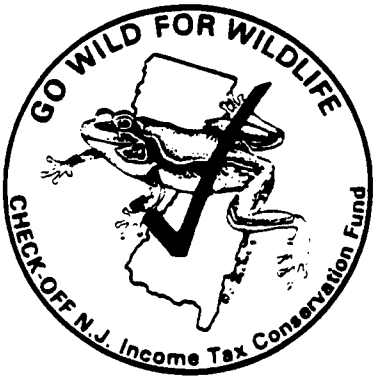


Table 3. Size of use areas and percent devoted to various land use classifications for Upland sandpipers.*

Study Site	Use Area Size in Acres	Row Crops	Wheat and Rye	Hayed and Mowed	Pasture	Other Uses
Featherbed Lane Salem County	503	18.9%	1.1%	21.5%	51.4%	7.1%
Harrisonville Road Gloucester County	128.5	20.7%	15.6%	22.2%	39.6%	2.0%
Burlington County Airpark Burlington County	110.25	0.0	29.7%	44.4%	0.0	25.9%
New Freedom Road Burlington County	155.25	54.5%	0.0	26.4%	3.3%	15.9%
Orchard Road Hunterdon County	140.00	21.3%	5.7%	9.9%	49.6%	13.5%
Orchard Drive, Beekman Lane Somerset County	242.75	21.1%	6.9%	48.9%	12.3%	10.8%
Average of All Sites	213.30	22.7%	9.8%	28.8%	26.0%	12.5%

*from Plage, Peter. 1983. Upland sandpiper Habitat Characterization. Report submitted to the Endangered and Nongame Species Program.

Northern Harrier

New Jersey's breeding population of harriers is concentrated on the Delaware and Atlantic Coasts. Alteration of salt marsh habitat and pesticide contamination has contributed to the demise of the harrier.

In order to estimate population trends and identify and protect critical nesting habitat, the population of nesting harriers was surveyed by Peter Dunne working under contract for the Endangered and Nongame Species Program in 1979 and resurveyed in 1983. All searches were done by boat from April 5th through July 26, 1983 between 6:00 a.m. and 11:00 a.m. Breeding locations were identified by the presence of an adult male exhibiting territorial behavior; young birds; or a prey exchange between adult males and females.

A total of 43 confirmed nesting attempts were found during this survey. Breeding harriers have dramatically increased (139%) since the 1979 survey, yet the harrier population is not "out of the woods". Only 15 of the 43 known nests produced young in 1983. Because there are so few nesting pairs with pressure on their nesting habitat, the harrier's breeding status was officially changed this year from threatened to endangered.

Future plans will be made to ensure the survival of the harrier. Plans include monitoring the population via similar surveys and identifying individual nests at three harrier strongholds at Dividing Creek, Dennis Creek and Tuckahoe River. The nest substrate, adjacent habitats, hunting areas, and nesting success of Delaware Bay and Atlantic coast pairs will be studied in future work.

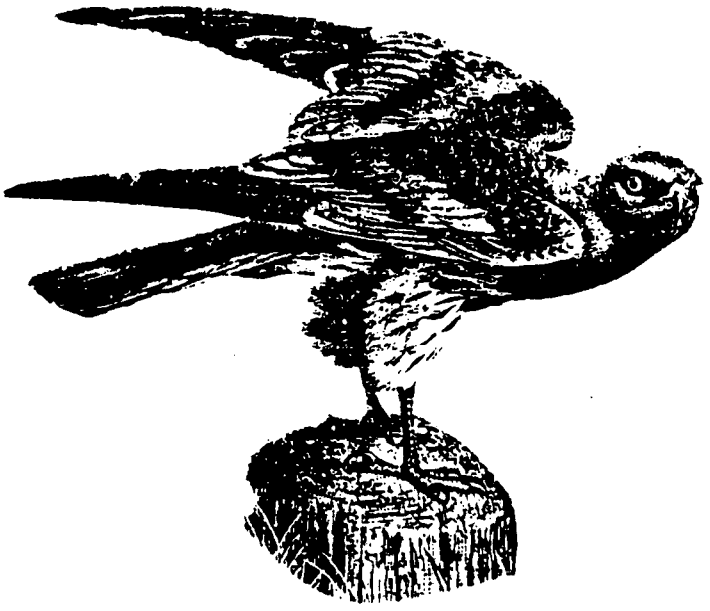


Table 4. A comparison of confirmed nesting attempts per site in coastal marshes of New Jersey between the 1979 and 1983 Northern Harrier Surveys *.

Location	Nests 1979	Nests 1983	Difference
Mad Horse Creek	2	2	0
Raccoon Ditch	1	0	-1
Greenwich	1	1	-
Back Neck (formerly Sea Breeze)	1	2	+1
Sea Breeze	0	2	+2
Sayre's Neck	0	2	+2
Bay Point	0	1	+1
Money Island	0	1	+1
Gandy's Beach	2	1	-1
Egg Island Point	1	1	0
Fortescue	1	2	+1
Turkey Point	3	7	+4
Hansey Creek	0	1	+1
Berrytown (formerly Port Norris)	1	3	+2
Heislerville	1	0	-1
Dennis Creek	1	5	+4
Reed's Beach	1	0	-1
Tuckahoe/Corbin	1	6	+5
Wading River	0	1	+1
World's End Creek	0	1	+1
Marshelder Islands	0	1	+1
Flat Island	0	1	+1
Cedar Bonnet Island	0	1	+1
Barnegat	0	1	+1
Dipper Point	1	0	-1
Total:	18	43	25

* from Dunne, Peter. 1983. The 1983 Northern Harrier Breeding Survey in Coastal New Jersey Marshes. Report submitted to the Endangered and Nongame Species Program.

Summer Bats

Cryptic and solitary species of bats that summer in New Jersey have been an enigma for much of this century. Unlike their relatives that cluster in caves, barns and sometimes houses, "summer" bats in New Jersey tend to be solitary, and thus more difficult to survey. In order to assess distribution and abundance of these species and protect their summering habitat, a good survey technique was sought in 1983.

Using accoustical "mini bat detectors", the ultrasonic cries of the big brown bat , little brown bat, and Keen's myotis as well as Eastern pipistrel were recorded by Dr. Robert Martin, contracting biologist. Other bat species with an uncertain status are scheduled to be recorded next year - the silver haired, red, hoary bat, and the small-footed myotis. Apparently, most of the species can be identified from the sounds they emit that are picked up by the "mini-bat detectors" and recorded. The limits of the detector system are currently being tested and compared to conventional survey techniques. If the "mini-bat detector" system can be used to identify most of the summer bat species, it will be an invaluable tool.

Insect-eating Small Mammals

Small mammals have never garnered the attention of wildlife enthusiasts that the birds and certain reptiles have received. Thus there has been a lack of recent information on the distribution and abundance of species like the masked shrew, least shrew, starnose mole and woodland jumping mouse.

Reliable survey methods were sought for these undetermined species in 1983. Since the Great Swamp National Wildlife Refuge has a variety of habitats - freshwater marsh, young grassland, old field, forested wetland and upland forest - it was chosen for field testing survey techniques. Drs. Harvey and Ann Katz and Robert Dowler working under contract evaluated the effectiveness of various trapping methods for catching insect-eating mammals. Trapping methods that were evaluated include pit traps and Sherman live-traps with and without drift fencing.

As a result of this study, survey methods will be chosen for broad-based studies designed to establish the distribution and relative abundance of the little-known mammals.

Woodrat and Longtail Shrew

Similar only in name, the woodrat bears little resemblance in appearance and habit to its inner-city European relative. The woodland animal is secretive and less gregarious than the pestiferous Norway rat and prefers wild-grown plant and animal matter to table scraps and garbage.

Due to the sharp decline in the species throughout New York and Pennsylvania and lack of information about the species in New Jersey, the Program contracted with Dr. John Hall to gather information on the species.

Woodrats have been confirmed in the Palisades area of Bergen County and the Picatinny Arsenal of Morris County. Field checking of suitable rocky, talus slope habitat continues in the northwestern part of the state.

A vegetation analysis of the Palisades area was undertaken in the summer of 1983. Using a 5,000 square meter grid, the plant type and percent of cover was recorded. Though the final analysis has not yet been completed, preliminary findings indicate that seed of the Royal Pawlonia tree may be a significant food source. As the project continues, complete information will be available on habitat requirements and more information will be available on distribution of the woodrat in the state.

Less in known of the distribution and abundance of the Longtail shrew in northern New Jersey. A suspected site in Stillwater Township, Sussex County was field-searched this year by Dr. Hall without success and will be rechecked in 1984. Other sites will be checked for the insectivore as work continues on the project.

Population and Habitat Management

Reports in this section are summaries of habitat or population management projects. In some cases, populations of endangered and threatened species were manipulated to increase their productivity. In other projects, habitat was manipulated.

Eastern Tiger Salamander

This large, black and yellow salamander has been on the decline in New Jersey due to habitat loss. Temporary gravel-bottom ponds required for breeding are vulnerable to filling and pollution. In order to maintain this endangered species in New Jersey, potential habitat on protected land will be sought out and ponds will be managed for the amphibians.

One such pond was created this year on Greenwood Forest Wildlife Management Area at Howardsville by the Division's Bureau of Wildlife Management. This 100' X 150' pond will receive tiger salamander eggs from a population whose future habitat is in jeopardy. The ponds are designed to be temporary in nature and dry up in the late summer to eliminate predators.

A similar pond created at Higbee Beach Wildlife Management Area in 1981 provides a predator-free environment for the salamander larvae. In order to better understand the population dynamics of the salamander, a branding program was undertaken in June, 1983. As the salamanders left the pond, they were funneled alongside the pond by means of drift fencing into 8" X 10" pits where they were collected and branded. Over the course of the summer, 297 salamanders were marked using an L-shaped piece of 18-19 gauge steel wire. The brand on the dorsal middle just below the shoulder blades will last 21 months.

Future plans for the Higbee salamanders include continual stocking of egg marking and pond maintenance.

Corn Snake

The decline in population of the corn snake has been documented for several years. The severity of its decline led to the listing of the species on the endangered list in 1983.

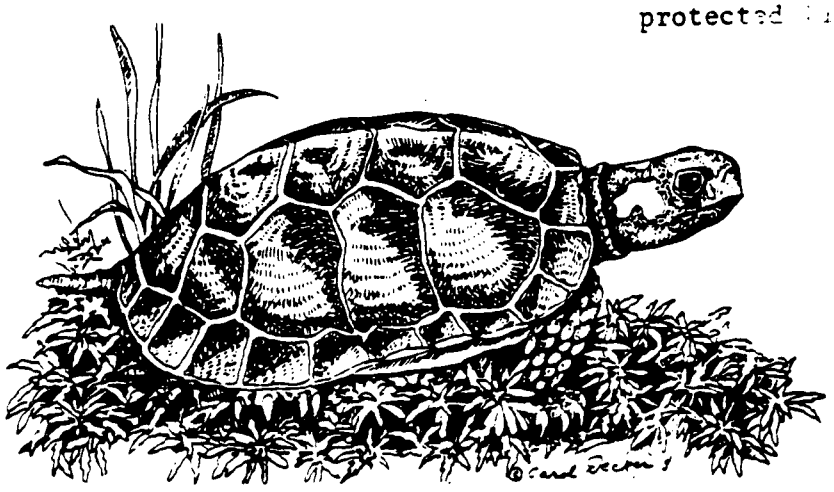
To enhance the extant populations, management efforts have included an ongoing captive breeding project. Working under contract, H.A. raised and released 19 captive-bred snakes into the wild at Greenwood Forest Wildlife Management Area in 1982 and 18 snakes in 1983. Six females and three males are being maintained in captivity for reproduction. Other protective measures include increased law enforcement efforts to apprehend illegal collectors and habitat improvements.

Bog Turtle

For over five years data on optimum bog turtle habitat has been collected from northern and central New Jersey by Herpetoloical Associates working under contract. This year, that data was put to use in managing habitat for the endangered turtle on the Manasquan Wildlife Management Area in Monmouth County.

To provide the open swamp situation needed by the bog turtle for breeding, saplings were cleared from the primary breeding area and rivulets. From April 15 to June 15, biologists documented wildlife observed, vegetation growth, water level and bog turtle activity. A positive response has been documented from smaller openings created on other locations; time will tell if the Manasquan Colony responds favorably.

Follow-up observations of the Manasquan Colony will be made in 1984 to determine if the openings should be maintained. If successful, the management strategy will be applied to other colonies on protected land.



Least Tern

Least tern colonies utilizing barrier and mainland beaches have continually suffered losses during the breeding season due to disturbances. This endangered species is now known to nest on only 21 sites along the Atlantic coast. In order to perpetuate colonies on protected areas, a project was initiated in 1983 by Dr. Joanna Burger, working under contract with the Endangered and Nongame Species Program.

Twenty tern decoys were used at Mike's Island, Cedar Bonnet Island and Island Beach State Park. These islands were chosen for their protected location and historical use by nesting terns.

Decoys at Mike's Island succeeded in attracting terns to nest. That island had not been used by terns since 1980. Least terns did not nest on Island Beach despite extensive decoy work. The results from Cedar Bonnet Island were difficult to interpret; the established colony from which the new colony would have been drawn failed due to predation.

Experiments conducted on Brigantine indicated that terns are more attracted by 20 decoys than by 10.

Further experimentation will be done in coming years to establish the critical endangered birds on readily protected site In the mean time, fencing and posting of colonies with signs will alert people to the problems of disturbing the nesting terns.

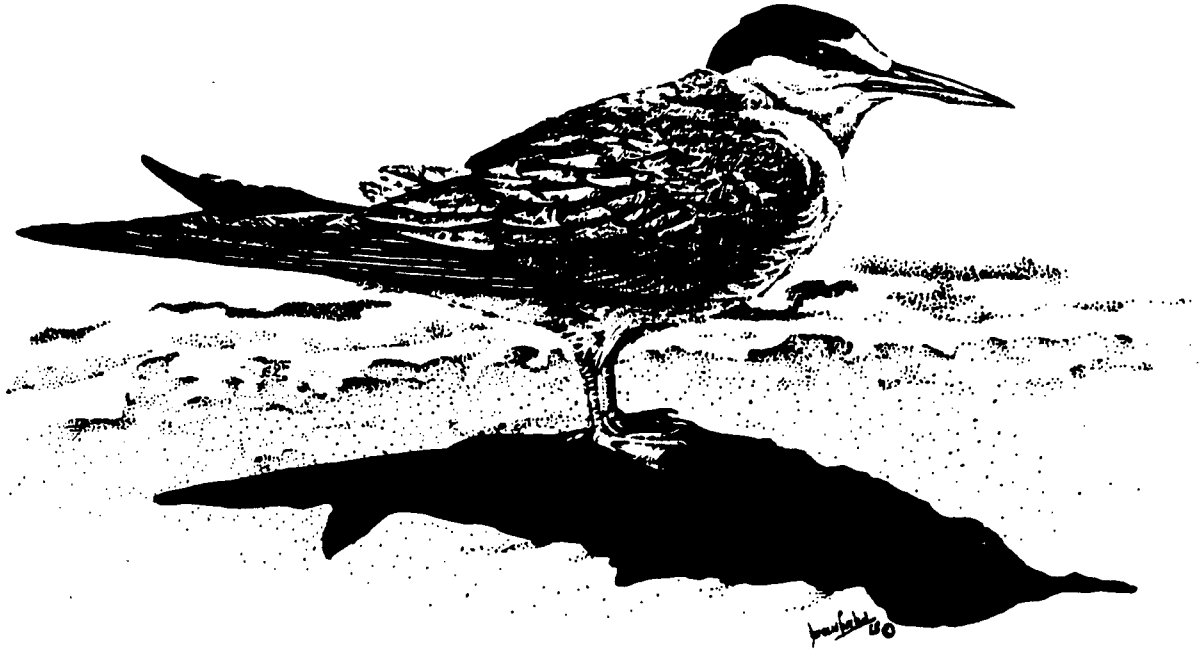


Table 5. Breeding Populations and Reproductive Success of Least Terns in New Jersey, 1983 *.

	Number of Adults	Number of Nests	Number of Fledged Young[a]	Number Young Fledged Per Nest	Problems
Global Terminal	60	20	5	.25	humans
Sandy Hook North	150	60	40	.67	humans
Sandy Hook South	150	50	20	.40	humans
Mike's Island	50	20	17	.85	predation
Ortley Beach	8	3	1	.33	predation
Island Beach	6	0	0	-	
Barnegat Island	15	0	0	-	
Holgate	600	300	0	.00	predation
Cedar Bonnet	72	38	38	1.00	humans
Brigantine Beach	550	270	150	.56	humans
Absecon Blvd. West	7	0	-	-	
Absecon Blvd. East	36	18	3	.17	humans
Peters Beach	6	2	1	.50	humans
Longport Sodbanks	22	10	10	1.00	
Corsons Inlet North	14	10	1	.10	humans
Corsons Inlet South	350	102	75	.74	humans
Two Mile Beach	10	1	1	1.00	
Cpae May Meadow	30	10	5	.50	humans
Magnasite Plant	2	1	1	1.00	
Glades Sand Plant	15	3	1	.33	
Hereford Inlet	3	1	0	.00	predation
Total	2156	919	369	.40	

[a] Determined from records of several observers and myself.

(om Burger, Joanna. 1983. Black Skimmer and Least Tern Survey and Restoration.) Report submitted to the Endangered and Nongame Species Program.

Table 6. Summary of New Jersey Least Tern Success, 1983 *.

	Number of Adults	Number of Nests	Number of Young	Number of Young Fledged per Nest
All Colonies	2,156	919	369	.40
Holgate	600	300	0	0
Non-Holgate	1,533	618	369	.60

* from Burger, Joanna. 1983. Black Skimmer and Least Tern Survey and Restoration. Report submitted to the Endangered and Nongame Species Program.

Black Skimmer

The endangered black skimmer nests on barrier islands and spoil banks in New Jersey's coastal area. Like the least tern, black skimmers have declined due to development of coastal areas and disturbance of colonies.

Protecting the remaining colonies has been the major objective of the project. In 1983, 1981 adults were reported by Joanna Burger at 10 colony sites. Large colonies were fenced and posted and some colonies were patrolled. Future plans include continued monitoring the colonies and protecting remaining sites.

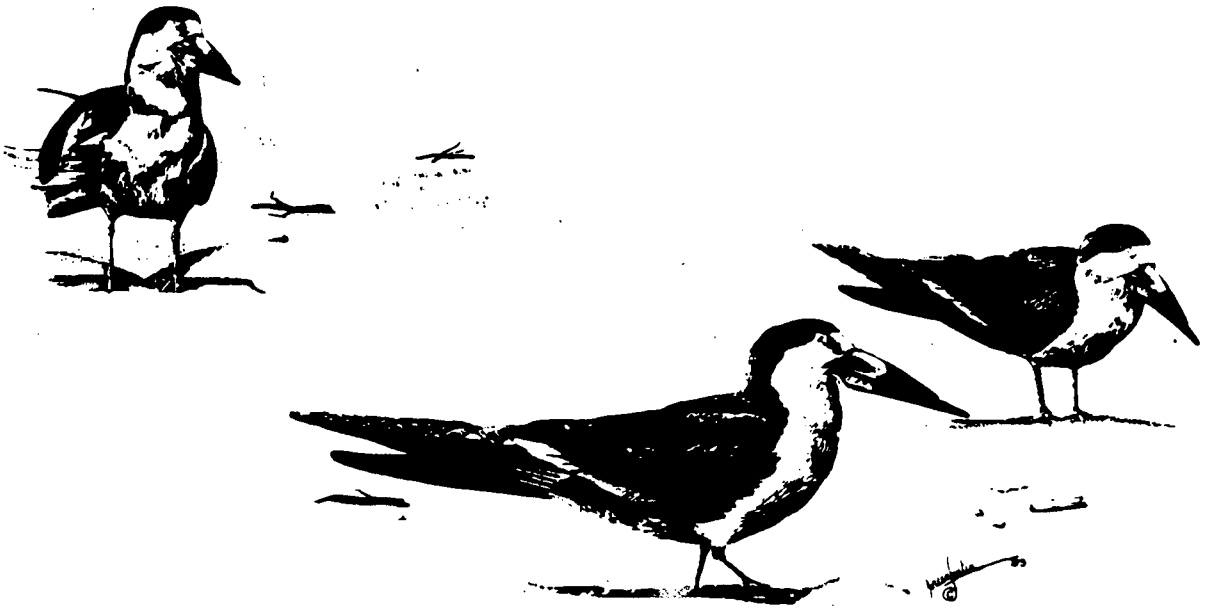


Table 7. Number of adult Black Skimmer in New Jersey breeding colonies*.

	1976	1977	1978	1979	1980	1981	1982	1983
Sandy Hook	50			2				
East Point				2				
E. Vol Sedge				4				
W. Vol Sedge		30	38	38	28	40	72	44
Gulf Point				2				
W. Sloop Sedge	26							
Flat Creek		4						
E. Carvel	32	28	14	28	90	40	42	28
W. Carvel	24	26	40	28	20	4		
W. Log Creek	42	30	16					
Log Creek	28							
Pettit				2	40	26	42	4
Cedar Creek	16	12					2	
SW Cedar Bonnet	16	8	0	26	20	32	2	
Thorofare				4				
Egg						2		2
E. Ham	16	14			110	6		
W. Ham				54	32	56	32	12
Marshelder				164				
Little					4			
Mordecai			12	142	2	10		
South Barrel		10		4				
Holgate	782	650	350	85	400	450	700	750
Little Beach	412	75						
Tow Island			150	400	50			
Brigantine			40					
Lelder Island			30					
Little Crooked				45				
SW Point Cove	2							
Strathmere Bay	700	900	650	850	500	350	200	85
Avalon Causway (Gravens Inlet)	130	250	589	66				
Corsons Inlet (s)								376
Townsend's Inlet							56	30
South Channel				30	55	50	44	
Stone Harbor Point					344	480	400	350
SW Point								
Hereford Inlet								
Total Birds	2,170	2,039	1,951	1,974	1,747	1,546	1,592	1,681

* from Burger, Joanna. 1983. Black Skimmer and Least Tern Survey and Restoration. Report submitted to Endangered and Nongame Species Program

Peregrine Falcon

The peregrine falcon has made a dramatic comeback in New Jersey. The Peregrine Fund of Cornell University put a major emphasis on New Jersey when planning the recovery which started in 1975. Over the course of the cooperative venture, 55 peregrines were hacked into the wilds of New Jersey. Birds have since nested on their own and produced 29 young in New Jersey.

This year marked the end of active involvement in the peregrine recovery project. With three new nesting towers completed at Swan Bay Wildlife Management Area, Tuckahoe Wildlife Management Area and Ocean Gate (at Toms River), peregrines that return to New Jersey to breed should find ample nesting sites. The Peregrine Fund's involvement ended after 7 years of hacking birds into New Jersey; natural reproduction is now well underway. Five locations are currently being used for nesting and 7 more should be used in coming years.

The peregrine's future in New Jersey is quite positive. Many people look for the return of the peregrine to their former New Jersey nesting site in the Palisades along the Hudson. Time will tell if the majestic bird can tolerate the strains of civilization and the predacious great horned owl. In the mean time, it seems certain that we will reach our goal of establishing 8-10 breeding pairs in New Jersey.

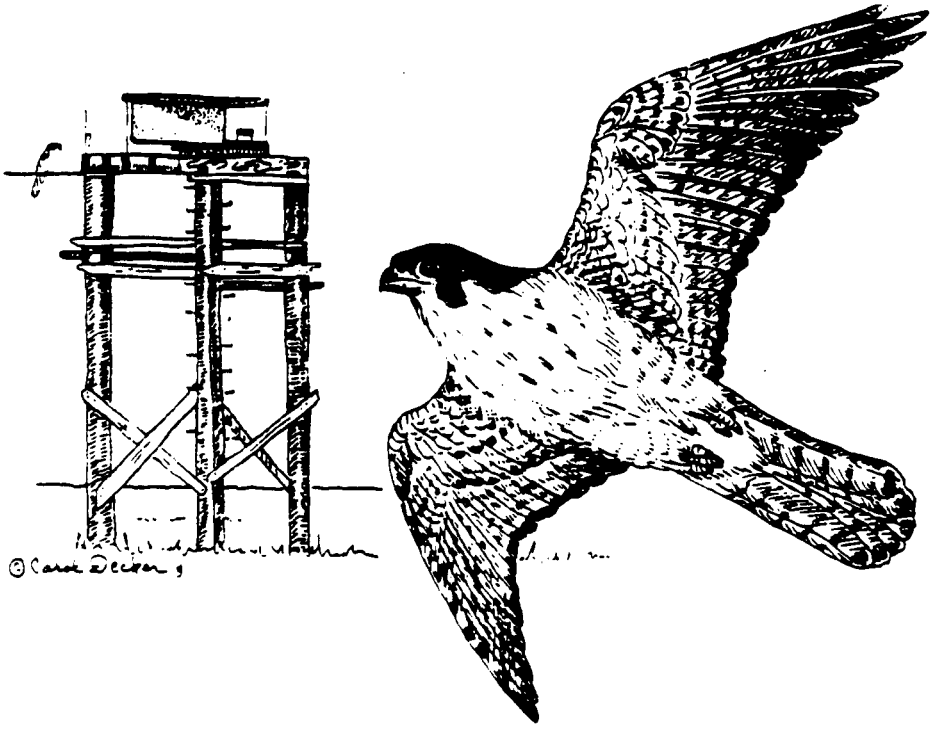


Table 8. 1983 Eastern Peregrine Reintroduction Summary *.

Location	No. Falcons Released	No. Lost	Cause	No. Dispersed Normally
SOUTHERN REGION				
Russell Is. VA	7	0	--	7
Cobb Is. VA	7	0	--	7
Great Fox Is. VA	4	3	Adult harassment	1
Clay Is. MD	6	1	Unknown	5
Baltimore MD	2	2	Impact Injuries	0
Manahawkin NJ	3	0	--	3
	29(37%)	6		23 (79%)
NORTHERN REGION				
Hurricane Mt. NY	6	0	--	6
Silver Lake NY	10	0	--	10
Azure Mtn. NY	4	0	--	4
Burnt Mtn. NY	7	0	--	7
Mt. Horrid VT	5	0	--	5
White Rocks VT	7	1	Unknown	6
Owl's Head NH	4	3	Unknown	1
Square Mtn. NH	7	0	--	7
	50 (63%)	4		46 (92%)
Total	--	--		--
	79	10		69

*from Barclay, John and Thomas Cade. 1983. Eastern Peregrine Falcon Reintroduction Program, 1983, Summary Report. Peregrine Fund. Cornell University.

Table 9: Peregrine Falcon Nesting Summary 1983 *.

Location	Number Hatched	Number Survived to Dispersal	Other Details
Manahawkin NJ	1	1	3 captive raised young fostered
Brigantine NJ	4	1	3 young disappeared at fledging
Sea Isle City NJ	4	4	---
Tuckahoe NJ	3	3	young not discovered until after fledging
Throg's Neck Bridge NY	2	1	1 young disappeared at fledging - vandals
Verrazano Bridge NY	3	3	---
Chincoteague VA	4	4	---
South Marsh Is. MD	2	2	---
Chesapeak Bay Bridge MD	0	0	failed late in incubation
9 attempts	23	19	
8 successful	2.5 yng/attempt	83% survival	

*from Barclay, John and Thomas Cade. 1983. Eastern Peregrine Falcon Reintroduction Program, 1983, Summary Report. Peregrine Fund. Cornell University.

Osprey

The osprey may be the first endangered species to be removed from the list, thanks to active management efforts. From 1974-1977, eggs and chicks from Cheseapeake Bay stock have been introduced to Garden State nests to supply young to New Jersey's pesticide-impaired adults. Platforms were also put up for New Jersey adults to offset the loss of existing nesting structures along the coast.

Since 1973, osprey management has involved annual surveys and the construction of platforms. The improvement in the coastal environment since the ban on the use of persistent pesticides has improved the nesting success of the osprey. Almost twice as many young were produced in 1983 as compared to 1976.

Efforts are being channeled into assessing osprey productivity inland. Though one has been found to date, it is expected that as the population expands, more pairs will be nesting inland.

Table 10. Summary of New Jersey Osprey Management 1974-1983. Endangered and Nongame Species Program.

YEAR	EGGS TRANSFERRED	CHICKS TRANSFERRED	TRANSFERRED EGGS HATCHED	TRANSFERRED YOUNG FLEDGED	NEST OCCUPIED ATL. & DEL. COASTS	NESTING POLES/PLATFORM CONSTRUCTION	STATEWIDE NUMBER YOUNG FLEDGED
1974	17 MD	0	10	5	not counted	0	not counted
1975	24 MD	6	13	18	not counted	0	not counted
1976	20 MD	2	10	8	62	4	59
1977	27 MD	5 (2 NJ young)	12	9	71	6	60
1978	10 NJ EGGS	2 NJ	5	5	68	22	65
1979	6 NJ EGGS	2 NJ	3	3	85	9	70
1980	0	2 NJ	0	2	86	24	83
1981	0	2 NJ	0	2	87	4	89
1982	0	4 NJ	0	4	97	4	102
1983	0	1 NJ	0	1	98	6	102

Bald Eagle

Perhaps the most critically endangered of all New Jersey species, the bald eagle has received major attention during the past several years.

One nesting pair of eagles remain in New Jersey. That nest lies near the Delaware Bay in a wooded swamp. Eggs from this pair have not been viable - they have failed to hatch under laboratory conditions - until this year. The pesticide residues in the birds still caused thinning of the egg shells, but the embryos were able to survive. This year, two young were hatched in an incubator at the USFWS's Patuxent Research Center. Because there was such a great difference in size between the two eaglets, the smaller one was "exchanged" for a captive bred chick. (The other New Jersey chick was successfully introduced to a Pennsylvania nest.) Both New Jersey young fledged from the nest in June of 1983.

An ambitious eagle hacking project was undertaken in the summer of 1983. With the help of Atlantic Electric Company, New Jersey Bell and AT & T, a hack tower was installed by Natural Lands Trust, Inc. on land leased by the Program. This "eagle condominium" housed six Canadian-born eaglets. When the eagles were released in August and September, their movements were trailed with radio telemetry until they disappeared from the area.

Plans are underway to hack more birds next year. The Program hopes to establish 8-10 breeding pairs of bald eagles in New Jersey's coastal area. This figure approximates pre-DDT numbers. Eggs produced by the single nesting pair will be analyzed yearly for pesticide contamination and young birds will be supplemented until the pair can successfully produce young on their own.

A survey of wintering eagles has been conducted annually. The 1983 survey included the Upper Delaware River (coordinated by contractor John Kolodziej), Delaware Bay (coordinated by contractor Peter Dunne) and Atlantic coastal Burlington and Atlantic Counties (coordinated by contractor Peter Plage). Ground, boat and aerial counts revealed 12 bald eagles and one golden eagle.

Cliff Swallow

This attractive swallow was a familiar bird in New Jersey in and around towns, farms and open country prior to the 1960's. They prefer open fields and water for foraging on insects and attach their flask-shaped mud nest to wood, stone, concrete and sometimes steel surfaces of barns, bridges and other structures. English sparrows, introduced to the New Jersey area in the mid-1800's, have been successfully outcompeting the swallow for nesting sites. Swallow colonies have become few in recent years prompting the inclusion of the species on the endangered list.

Colonies under bridges over water seem to fare better against the aggression of house sparrows. In New Jersey, colonies along the Delaware River have been surveyed and one colony managed to improve the productivity of the nesting swallows.

Swallows were encouraged to nest early at the Lambertville-New Hope Free Bridge by the use of artificial nesting structures. Mud and plaster of paris casts were located under the bridge and ready for the birds when they returned in April. In 19 of the 35 artificial nests used by the colony, pairs produced two broods. This compares quite favorably to three second broods produced from 96 "natural" nests.

Future plans include continued monitoring and inspection of colonies. New colonies may be created by the use of artificial structures at several Delaware River locations.

Lakewood Township L.F.
New Hampshire Ave
Lakewood Twp
Ocean
NJA 98077111

Habitat Protection

Reports in this section summarize habitat protection efforts.

Environmental Review

Endangered species regional zoologists reviewed and provided comments on over 75 environmental reviews in 1983. Some of the projects reviewed for impacts on wildlife included water supply reservoirs, landfills, housing developments, mosquito control work, sewer lines and business office complexes. Many of the environmental reviews involved wetlands and other sensitive wildlife habitat.

Program zoologists were able to provide mitigation plans in many of these projects to salvage valuable habitat and populations of endangered species. In Somerset County, a mitigation plan was developed in cooperation with Department of Environmental Protection's Division of Water Resources to salvage bog turtle habitat. In Hudson County an urban least tern management area will be created as a result of mitigation for the development of a new coal transhipment facility. In Ocean County, snake homes will be built and populations transferred from the site of a housing development to a protected woodland. Program zoologists cooperate with the Army Corps of Engineers, USDI Fish and Wildlife Service, other state agencies and conservation groups to identify important habitats and prevent adverse impacts.

Landsat IV

In order to direct habitat protection efforts to key areas, a statewide mapping system will be employed. NASA's satellite, Landsat IV, orbits the earth every 17 days and sends data back to NASA for computer interpretation. The satellite can detail habitat information to 1/5 of an acre.

In New Jersey, satellite information is available for the majority of the state. To initiate state mapping, 30 habitats were chosen to be mapped on three different study sites. In cooperation with the Division's Bureau of Wildlife Management and DEP's Office of Natural Lands Management, these sites will be computer-analyzed and ground-checked.

Biologists hope to share the information (when available) with land use planners and others concerned about wildlife habitat

Management Planning

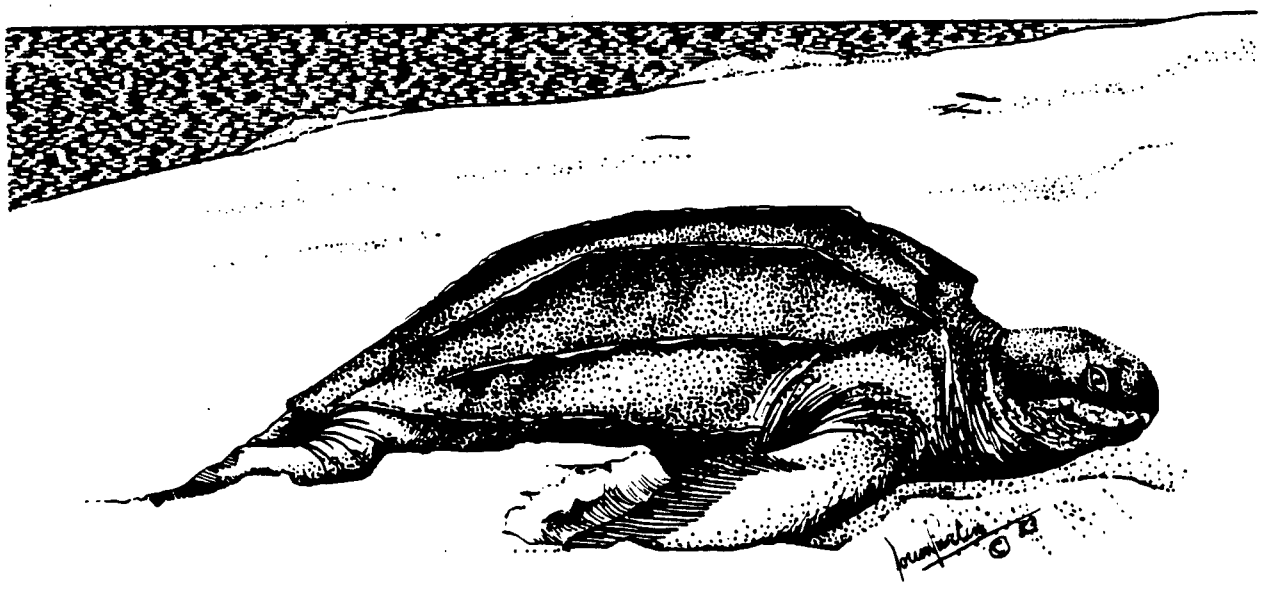
Habitat protection was facilitated at several locations this year through the development of management plans.

Plans were developed for the Higbee Beach Wildlife Management Area in Cape May County. This area was purchased with Federal Endangered Species and Green Acres Bond monies in 1978. Many recreational uses are supported by the Higbee tract; managing those uses in the best interest of wildlife and people was one of the major objectives of the plan.

Higbee is composed of several different habitat types and is nationally known for its concentrations of migrating songbirds, raptors, woodcock, lepidopterans, insects and bats.

Program zoologists developed habitat management plans and education program plans for the Pequest Wildlife Management Area. This 2000 acre Warren County area is the site of a new trout hatchery and major education facility.

Program zoologists also developed nongame habitat management plans for High Point State Park and the Delaware Water Gap National Recreation Area.



REFERENCE #6

WERBIN

STATE OF NEW JERSEY
DEPARTMENT OF CONSERVATION
AND ECONOMIC DEVELOPMENT

DIVISION OF WATER POLICY
AND SUPPLY

SPECIAL REPORT 29

GEOLOGY AND GROUND-WATER RESOURCES OF OCEAN COUNTY, NEW JERSEY

Prepared in Cooperation With
United States Department of the Interior
Geological Survey

1969

GROUND-WATER HYDROLOGY

SOURCE, OCCURRENCE AND MOVEMENT

Ground water is defined as that part of the water beneath the surface of the earth that occurs in the zone of saturation. The water table is near the upper surface of the zone of saturation. In the zone of saturation, all the connected pores, crevices, and voids in the rock are filled with water which in the capillary fringe is under pressure less than atmospheric and below the water table is under pressure greater than atmospheric. In Ocean County, virtually all available ground water occurs in the pore spaces of the Coastal Plain sediments, which overlie consolidated crystalline bedrock.

The quantity of water in storage in the Coastal Plain sediments is appreciable and can be calculated from the porosity and volume of material. The average thickness of the unconsolidated sediments underlying Ocean County is about 3,000 feet. The average porosity of the materials is about 30 percent. The product of these figures times the area of Ocean County, 750 square miles, gives an estimate of ground water in storage in the county of 140 x 10^3 billions of gallons. Of course all water in storage is not available for recovery. Some of it would be retained in the aquifer even if the aquifer were dewatered. Furthermore it is not desirable or economically feasible to withdraw all available water in storage.

Precipitation is the source of all ground water in Ocean County. About two-fifths of the precipitation falling on the county infiltrates to the zone of saturation. The sandy surface materials are highly permeable permitting rainfall to infiltrate rapidly.

As water seeps into the ground, some is evaporated, some is taken into the roots of plants and eventually transpired, and some is held by surface tension and capillary forces in pore spaces of the zone of aeration. As the soil becomes saturated, the weight of the water overcomes the capillary forces holding the water in the soil and water percolates to the water table.

The amount of the precipitation that infiltrates to the zone of saturation depends on several factors. During the growing season, plants create soil-moisture deficiencies which must be satisfied before appreciable amounts of water infiltrate to the water table. The growing season from May to October is a period of high evapotranspiration, whereas from November to April little evapotranspiration occurs. Hence, ground-water recharge occurs largely in the November to April period.

Formations capable of yielding water to a well are called aquifers. Depending on the location in Ocean County, there are from 1 (Long Beach Island) to 5 (New Egypt) principal aquifers available as a source of fresh ground water. Formations that are relatively impermeable and do not yield water readily to wells are termed aquitards or confining beds.

A quantitative measure of the water-bearing ability of a rock material is its field coefficient of permeability. As defined and used by the U. S. Geological Survey, it is the rate of flow of water in gallons per day through a cross-sectional area of materials of one square foot under a hydraulic gradient of one foot per foot at the prevailing temperature. The laboratory coefficients of permeability for sediment samples of formations exposed in the county are given in table 5. The measure of an aquifer's ability to transmit water is its coefficient of transmissibility which is the product of the field coefficient of permeability times the saturated thickness of the aquifer.

A measure of an aquifer's capacity to store water is its coefficient of storage. This is defined as the amount of water released from storage in a unit vertical prism of the aquifer as the hydraulic head declines one foot.

Ground water occurs either under water-table or artesian conditions. Under water-table conditions, the aquifer is unconfined and the static water level in a well is at or below the top of the aquifer. Under artesian conditions, the aquifer is confined by beds of low permeability and the piezometric surface or level at which water will stand in a well is above the top of the aquifer.

When a well tapping an unconfined aquifer is pumped, water is withdrawn largely from storage in the vicinity of the well. The pumping effect is transmitted slowly to other parts of the aquifer, and the water table declines as a result of gravity drainage. The ratio of the volume of water released by gravity drainage to the volume of the aquifer dewatered is the specific yield of the materials and is expressed in percent. Specific yield is approximately equal to the coefficient of storage for a water-table aquifer. The porosity or the percentage of void space in a material is always greater than the specific yield. The average porosity of the unconsolidated materials underlying Ocean County is relatively uniform—about 30 percent for sands and gravels as well as for clays. However, the specific yields of the different sediments differ widely. Values appear to be related to the grain-size distribution and degree of compaction. Fine-grained materials have a large surface area; therefore, surface-tension forces will retain a large portion of water from gravity drainage. The specific yield of clays and silts may be at most a few percent, whereas for a uniform sand it may be more than 20 percent.

Rhodehamel (1966, p. 44) estimated the specific yield of the Cohansey Sand to average 21 percent.

When a well tapping a confined aquifer is pumped, the aquifer remains saturated during pumping. Water is taken from storage until the cone of depression intercepts recharge that equals the rate of withdrawal. The volume of water released from storage per unit volume of aquifer in a confined aquifer is small compared to a volume released from a water-table aquifer in response to an equivalent decline in head. The confined aquifer is not dewatered as is the unconfined aquifer and water released from storage is attributed to compression of the aquifer. The coefficient of storage in most confined aquifers is less than about 0.001. The effect of pumping is transmitted to distant parts of the aquifer much faster in confined aquifers than in unconfined aquifers. Changes in head occur more quickly over more extensive areas in confined aquifers than in unconfined aquifers for a given rate of withdrawal. Generally, in any aquifer, it is desirable to withdraw water from an aquifer close to a recharge source so that a minimum lowering of the water level in the aquifer occurs.

WATER-LEVEL FLUCTUATIONS

Ground-water levels fluctuate in response to recharge from precipitation and discharge by springs, streams, plants, and wells. Water levels in wells tapping water-table aquifers respond to recharge more rapidly than wells tapping artesian aquifers.

In water-table aquifers, generally the deeper the water table the longer the time required for water to percolate to it. In observation wells in Ocean County where the water table is less than 5 feet below land surface, water levels may rise within a few days after a rainfall, but where the water table is, for example, 30 feet below land surface, several weeks or even months may pass before water levels rise after the same rainfall. Also, as depth to the water table increases, the magnitude of the water-level rise may decrease. An example of this is shown in water-level fluctuations of two water-table wells in the Cassville area. One has a static water level of 2 feet and the other has a level of 27 feet below land surface. In July 1959, in response to 13 inches of rainfall, the level in the shallow water-level well rose 1.5 feet while the level in the deeper water-level well rose only 0.4 feet.

Water-level fluctuations are influenced by the hydraulic properties of the aquifer. Hence, water-level fluctuations are greater in water-table wells tapping the Kirkwood Formation (in its outcrop area) than water-table wells tapping the Cohansey Sand because the fine sands of the

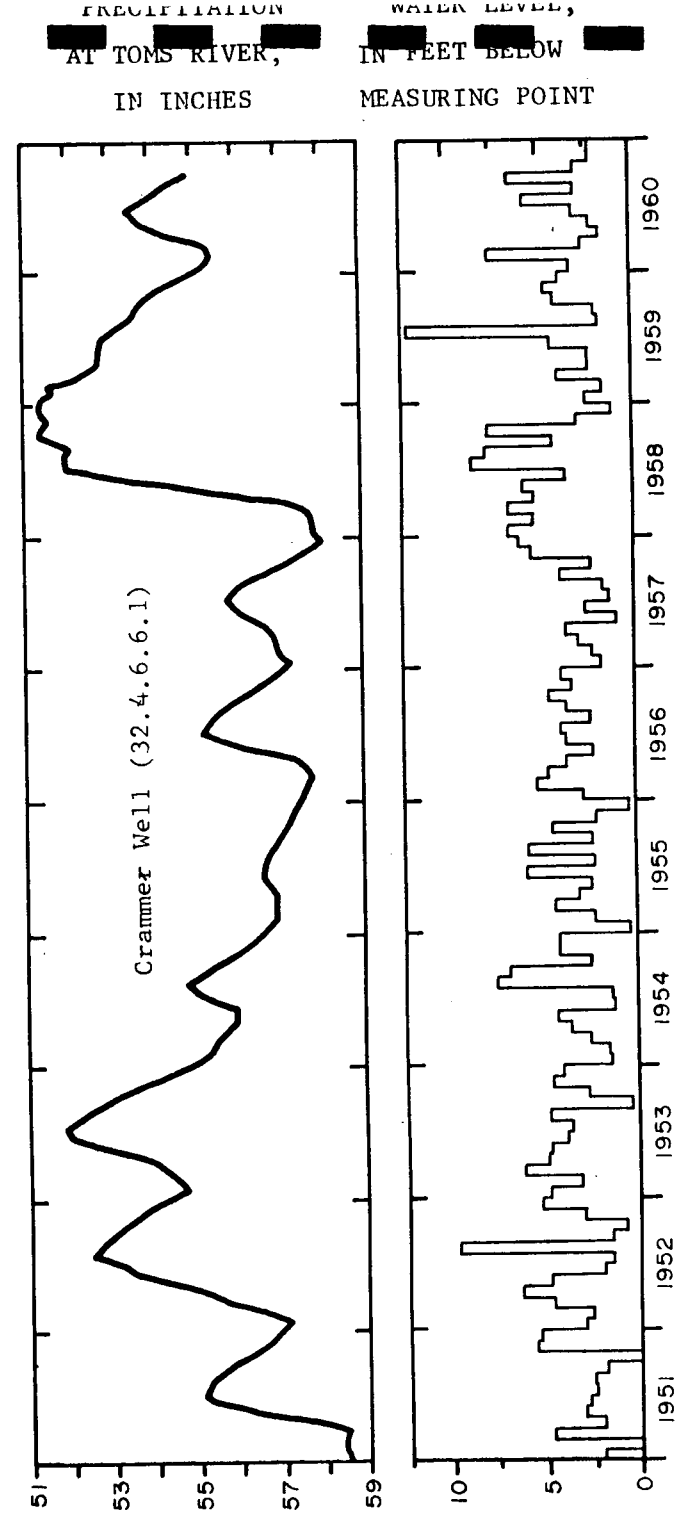


Figure 5.—Graphs showing fluctuations in a water-table observation well and precipitation at Toms River, 1951-60.

Kirkwood are less permeable and have a lower specific yield than the sands and gravels of the Cohansey.

Water levels generally decline during the growing season because much of the precipitation is intercepted by vegetation before it can reach the water table. However, the seasonal rise and fall of water levels in wells where the water table is deep may lag several months behind the change in seasons. Hence, in the Crammer well (32.4.6.6.1) at Whitings the seasonal decline generally starts in July or August, whereas the growing season in this area starts in April (figure 5). This lag is beneficial in areas of heavy pumpage because the water-table high occurs in the summer months when pumpage is greatest. Hence, the danger of wells "going dry" because the water level falls below the intake pipe is minimized. The hydrograph in figure 5 illustrates also that water levels in wells where the water table is deep reflect primarily general seasonal and climatic changes and not increments of recharge from single rainfalls.

Variations in lowest annual ground-water level in the Crammer well can be correlated with variations in annual precipitation. In figure 6, the difference in precipitation in a given water year from that of the preceding year is plotted as the abscissa and the difference in lowest water level in the Crammer well from the lowest water level of the preceding year is plotted as the ordinate. The period selected is the January or February low following the specified water year. The correlation between these two parameters suggests that for each 12-inch increase or decrease in precipitation, there is approximately a 2-foot rise or fall in the lowest annual water level in the Crammer well. As specific yield values for similar Coastal Plain sediments in the Pine Barrens region of New Jersey average 21 percent (Rhodehamel, 1966, p. 44) then 5 inches of the 12-inch change in precipitation percolates to the water table.

WATER USE

Public-water supplies in Ocean County are obtained entirely from ground-water sources. Pumpage for public supplies is subject to significant seasonal variation. For example, pumpage in July 1960 was about triple that of February 1960 and the average daily pumpage in July 1960 was almost double the average daily pumpage in 1960 (Table 2). These increases reflect the tremendous influx of tourists to the resort areas in the summer.

Toms River Chemical Company, which pumps about 2.5 mgd (million gallons per day), and the Glidden Co., near Lakehurst, which pumps about 5 mgd, are the significant industrial users of ground water in the

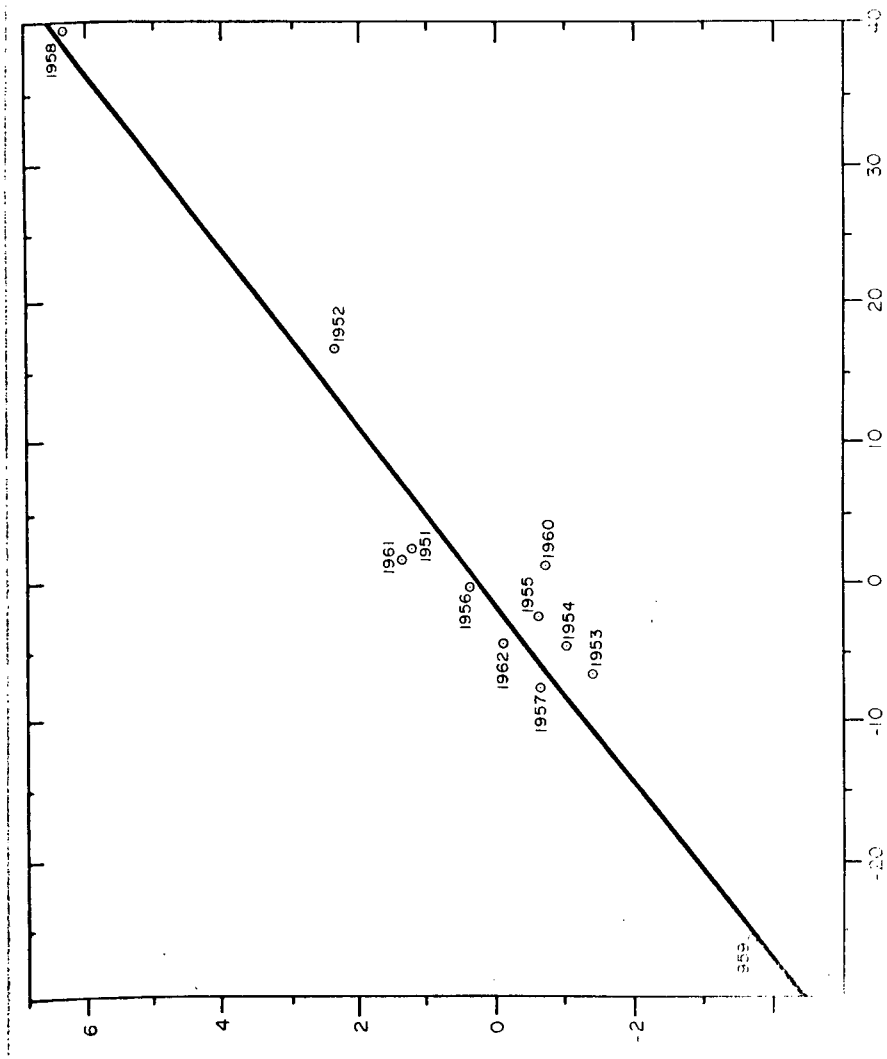


Figure 6—Graph showing relation of precipitation at Toms River to annual changes in lowest ground-water level of the Crammer well, 1951-62.

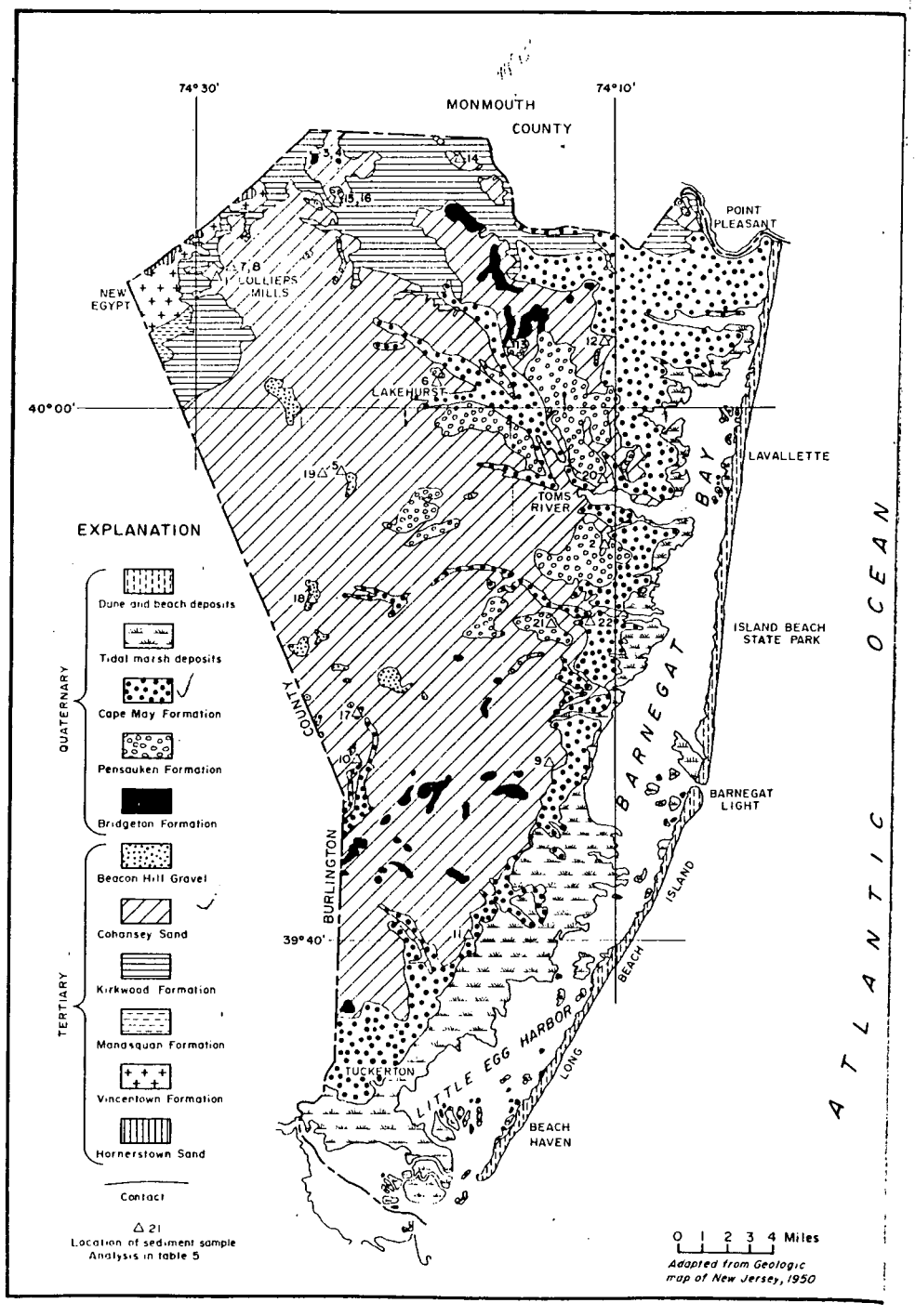
total average use by public-water supply companies of 7.8 mgd. In addition to these, Lakehurst Naval Air Station withdraws approximately 0.65 mgd from wells in the water-table aquifer to serve the installation.

According to the 1959 agricultural census, 1,402 acres on 53 farms were irrigated in 1953. In 1959, 476 acres on 14 farms were irrigated. Of the 14 farms, three obtained water from wells, the remainder used surface water. No estimates are available of the water used but because the irrigated land area is small and is decreasing, the water resources of the county are not appreciably affected by withdrawals for this purpose.

A large number of residents maintain privately owned wells, particularly in the cottage developments near the shore. The exact number of wells and their pumpage is unknown. However, assuming that most of the rural population (69,575 persons in 1960) obtains water from wells, a withdrawal of 5 mgd is a reasonable estimate.

The average quantity of ground water utilized in the county for public supply, industrial, and domestic purposes is estimated to be 23 mgd or 213 gallons per resident per day. This is equivalent to 36,000 gpd per square mile of land area or about three-fourths of an inch a year.

System	Series	Group	Formation	Lithology	Thickness	Water-bearing character
Quaternary	Holocene		Alluvium, beach sand and gravel	Gravel, sand, and clay	0-50	Unconfined water-table aquifer. Capable of yielding moderate to large quantities of water. Locally acidic, high in iron, and may have an odor. Contains saline water along the barrier bar and adjacent to Barnegat Bay. Utilized principally in Lakehurst and Toms River area where the average well yields are 320 gpm. Average specific capacity 12.8 gpm per foot. Confined water encountered beneath black clay layer along coast.
	Pleistocene		Cape May Formation		0-20	
			Pensauken Formation			
			Bridgeton Formation			
Tertiary	Miocene(?) and Pliocene(?)		Beacon Hill Gravel			
			Cohansey Sand	Sand, quartz, fine-to coarse-grained; locally clayey and clay.	0-200	
	Miocene		Kirkwood Formation	Sand, quartz, very fine to medium and coarse grained, micaceous, lignitic, silt, gray clay, and fine gravel lenses.	0-500	Confined aquifer. Yields moderate quantities of water. Locally may be acidic and high in iron content. Average well yield 420 gpm. Average specific capacity 10.6. Utilized chiefly on Long Beach Island and along coast north to Point Pleasant.
	Eocene		Manasquan Formation	Sand, Quartz-glauconite medium to coarse-grained, clayey, fossiliferous.	18-392	Aquitard - locally water bearing.
	Paleocene	Rancocas	Vincentown Formation	Upper - calcarenite, fine to medium-grained, glauconitic, quartzitic, fossiliferous. Lower-sand, quartz, glauconitic, fine to coarse-grained, clayey. Downdip-clay, glauconitic, fossiliferous.	25-328	Near outcrop, aquifer yields small quantities of water to domestic wells. Average yield 50 gpm. Average specific capacity 1. Water high in calcium, bicarbonate, and hardness. Downdip unit is an aquitard.
			Hornerstown Sand	Sand, glauconite, medium- to coarse-grained, clayey, fossiliferous.	30-50	Aquitard containing shell beds that yield small quantities of water.
Cretaceous	Upper Cretaceous	Monmouth	Red Bank Sand	Sand, quartz-glauconite, fine- to coarse-grained, clayey, lignitic.	10-50	
			Navesink Formation	Sand, glauconite, fine- to coarse-grained, clayey, fossiliferous.	?-100	
			Mount Laurel Sand	Sand, quartz, fine- to coarse-grained, glauconitic, fossiliferous.	40-128	Confined aquifer. Yields small quantities of water. Average well yield 70 gpm. Non-water bearing in southern half of county.
		Matawan	Wenonah Formation	Sand, quartz, fine-grained, micaceous, lignitic and silt, clayey.		
			Marshalltown Formation	Sand, glauconite and quartz, fine- to medium-grained, clayey, fossiliferous.	10-25	Aquitard.
			Englishtown Formation	Sand, quartz, fine- to medium-grained, micaceous, lignitic, clay seams.	0-75	Confined aquifer. Absent in southern half of county. Yields moderate quantities of water. Average well yield 269 gpm. Average specific capacity 2.6 gpm per foot.
			Woodbury Clay	Clay and silt, glauconitic, fossiliferous.	100-212	Aquitard.
			Merchantville Formation			
			Magothy Formation	Sand, quartz, very fine- to medium-grained, glauconitic, micaceous, clay.	600-2,000	Several confined aquifers. Yields large quantities of water high in iron content. Average well yield 600 gpm. Average specific capacity 26.0 gpm per foot. Ground-water temperature above 70°F. Saline water below 2,500-foot depth.
			Raritan Formation	Sand, quartz, fine- to coarse-grained arkosic, siderite, clay. Calcareous and kaolinitic downdip.		
-Cretaceous	Precambrian and early Paleozoic rocks - schist, gneiss, pegmatite, and gabbro. Triassic sandstone, shale, and basalt.			Weathered gneiss	65	
				Biotite gneiss with pegmatite veins	----------	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MONMOUTH COUNTY
POINT PLEASANT
NEW EGYPT
LAKEHURST
LAVALLETTE
TOMS RIVER
ISLAND BEACH STATE PARK
BARNEGAT LIGHT
BARNEGAT BAY
BARNEGAT ISLAND
LONG BEACH ISLAND
BURLINGTON COUNTY
TUCKERTON
LITTLE EGG HARBOR
BEACH HAVEN
ATLANTIC OCEAN
EXPLANATION
QUATERNARY
TERTIARY
Dune and beach deposits
Tidal marsh deposits
Cape May Formation
Pensauken Formation
Bridgeton Formation
Beacon Hill Gravel
Cohansey Sand
Kirkwood Formation
Manasquan Formation
Vincentown Formation
Hornerstown Sand
Contact
Location of sediment sample
Analysis in table 5
0 1 2 3 4 Miles
Adapted from Geologic map of New Jersey, 1950

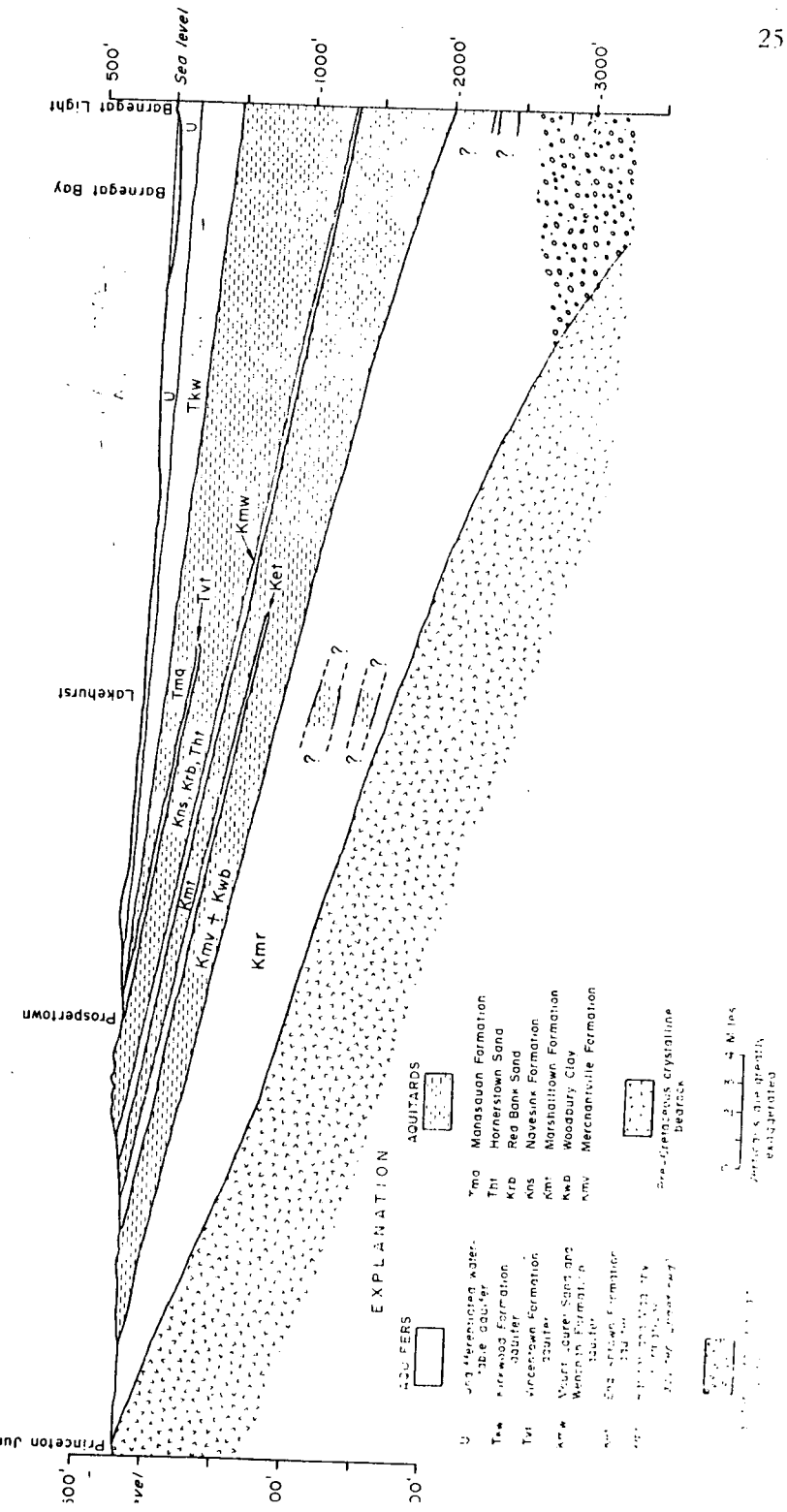

A'
A
Sea level
500'
1000'
2000'
3000'
Barnegat Light
Barnegat Bay
Lakehurst
Prospertown
Princeton Junction
Tkw
Tmq
Tvl
Kmw
Kel
Kns, Krb, Thl
Kml
Kmv + Kwb
Kmr
EXPLANATION
AQUIFERS
AQUITARDS
Tmq Manasquan Formation
Thl Hornerstown Sand
Krb Red Bank Sand
Kns Navesink Formation
Kml Marshalltown Formation
Kwb Woodbury Clay
Kmv Mercerville Formation
Pre-Cretaceous crystalline bedrock

Table 4.—Summary of availability of ground water in Ocean County.

Aquifers: U, undifferentiated water-table aquifer; K, aquifer in the Kirkwood Formation; V, aquifer in the Vincentown Formation; W, aquifer in the Wenonah Formation and Mount Laurel Sand; E, aquifer in the Englishtown Formation; R, aquifer in the Raritan and Magothy Formations. Areas are shown in figure 13.

Area		Aquifers	Availability of ground water
1	Summer Coastal Resort	K	K, yields as much as 500 gpm. Used for public supply. Potential sea-water intrusion as water levels are below sea level. Summer pumpage, 5 mgd. R and U contain saline water. E, W, and V are absent.
2	Undeveloped Pine Barrens	R, K, U	R, yields as much as 2,000 gpm possible. Saline water in southern part of area. K, well yields less than in Area 1. Water locally acidic and high in iron content. U, yields as much as 1,000 gpm possible. Water may be high in iron content, acidic, and odoriferous. E, W, and V are absent.
3	Urban	R, E, W, K, U	R, same as in area 2. Pumpage 5 to 8 mgd. E, yields up to 500 gpm. Highly developed. Pumpage, 3 mgd. Sea-water intrusion possible as water levels have declined as much as 90 feet. W, yields less than 100 gpm. Relatively undeveloped. Pumpage less than 1 mgd. K, yields up to several hundred gpm. U, same as in area 2. V, absent.
4	Rural	R, E, W, V, K, U	Small amounts pumped for domestic use. R, E, K, and W yields up to several hundred gpm are possible.

The Englishtown Formation, the Wenonah Formation-Mount Laurel Sand and Vincentown Formation are water bearing near their outcrop but in southern Ocean County they grade into relatively impermeable glauconitic marls. At a test well at Island Beach State Park, the relatively impermeable clay and glauconite sequence occurs from 400 to 2,000 feet in depth.

RARITAN AND MAGOTHY FORMATIONS

Geology

The Raritan and Magothy Formations are discussed as a single geohydrologic unit because of similar geologic and hydrologic characteristics in the subsurface. Together they constitute the oldest, deepest, and thickest unconsolidated unit in the county, composing half the thickness of the Coastal Plain sediments. They range in thickness from 600 feet at the northwest corner of the county to almost 2,000 feet at Island Beach State Park. The basal Raritan Formation overlies unconformably the early pre-Cretaceous metamorphic and igneous basement rocks. The Magothy Formation is overlain disconformably by black micaceous, glauconitic clay of the Merchantville Formation. In the subsurface, the Merchantville-Magothy contact is best shown in electric well logs (fig. 10) by the sharp increase in resistivity and spontaneous potential for the more porous Magothy (at 1,750 feet in fig. 10).

The Magothy Formation in its outcrop is characteristically a micaceous, fine-grained, lignitic sand interbedded with clays. The Raritan Formation in its outcrop is usually a lenticular, light-colored, medium-to coarse-grained, subangular, and arkosic quartz sand interbedded with varicolored kaolinitic clays. Fine gravel lenses also occur. Also common in the Raritan are lignite, iron sulfides, siderite, ironstone nodules, and fossil dicotyledon flora. In drillers' well logs, the Raritan and Magothy Formations are commonly described as a series of "sand-silt-sand beds." The Raritan and Magothy Formations in their outcrop area represent continental and marine deposition, but downdip beneath Ocean County, the sequence is predominently marine. Glauconite and marine fossils were found in wells at Point Pleasant, Normandy Beach, Lavallette, Lakehurst, Double Trouble, Island Beach State Park (fig. 3). Marine limestones occur at Point Pleasant, Double Trouble, and Island Beach State Park in the upper part of the Raritan and Magothy Formations.

The regional strike of the top of the Magothy Formation is approximately N. 45° E.; the dip is 50 feet per mile to the southeast. A structure contour and thickness map of the Raritan and Magothy Formations is shown in figure 11. The bedrock surface or the base of the Raritan Formation dips more than 100 feet per mile to the southeast as shown by the contour map in figure 12.

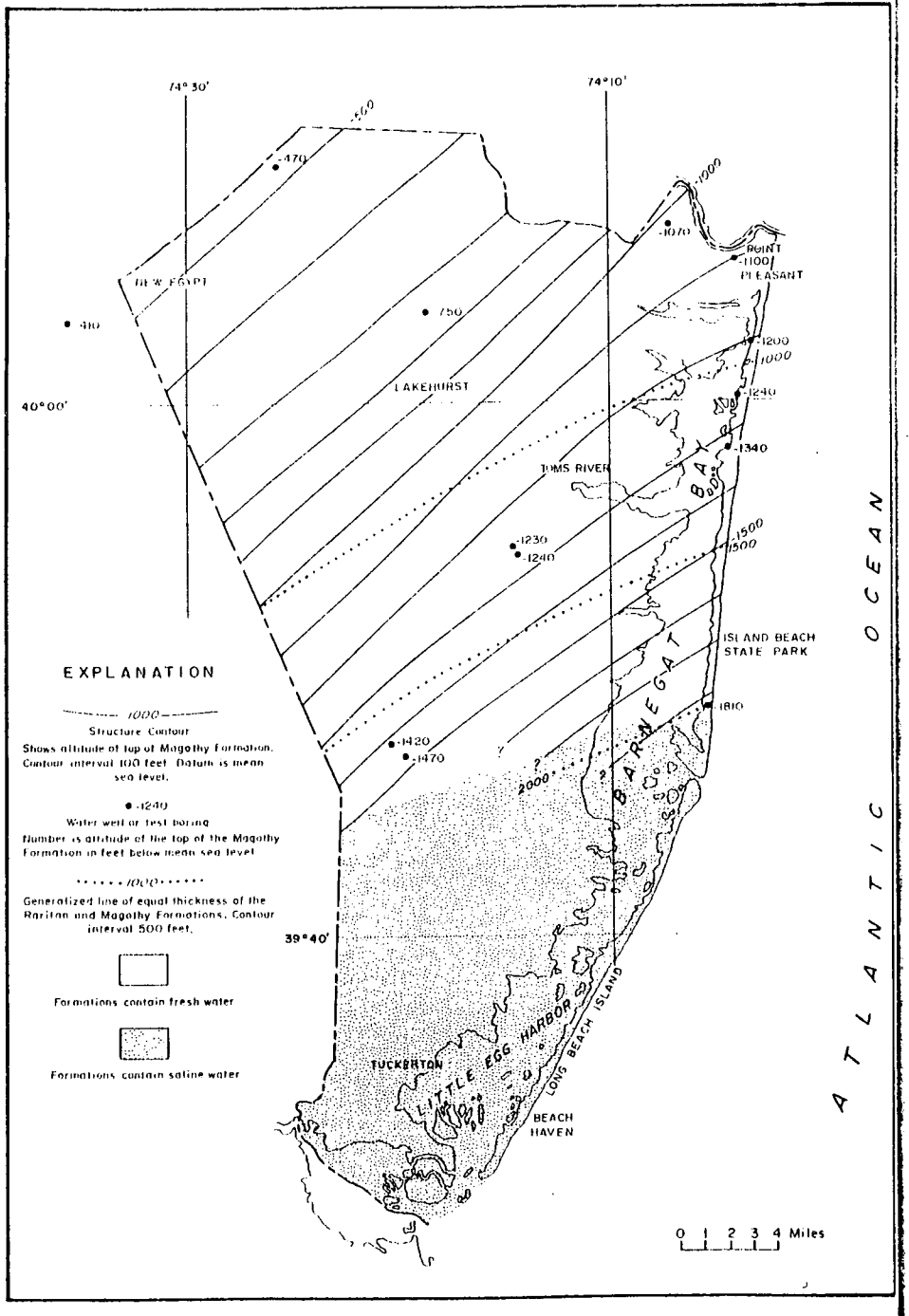


Figure 11.—Structure contour and thickness map of the Raritan

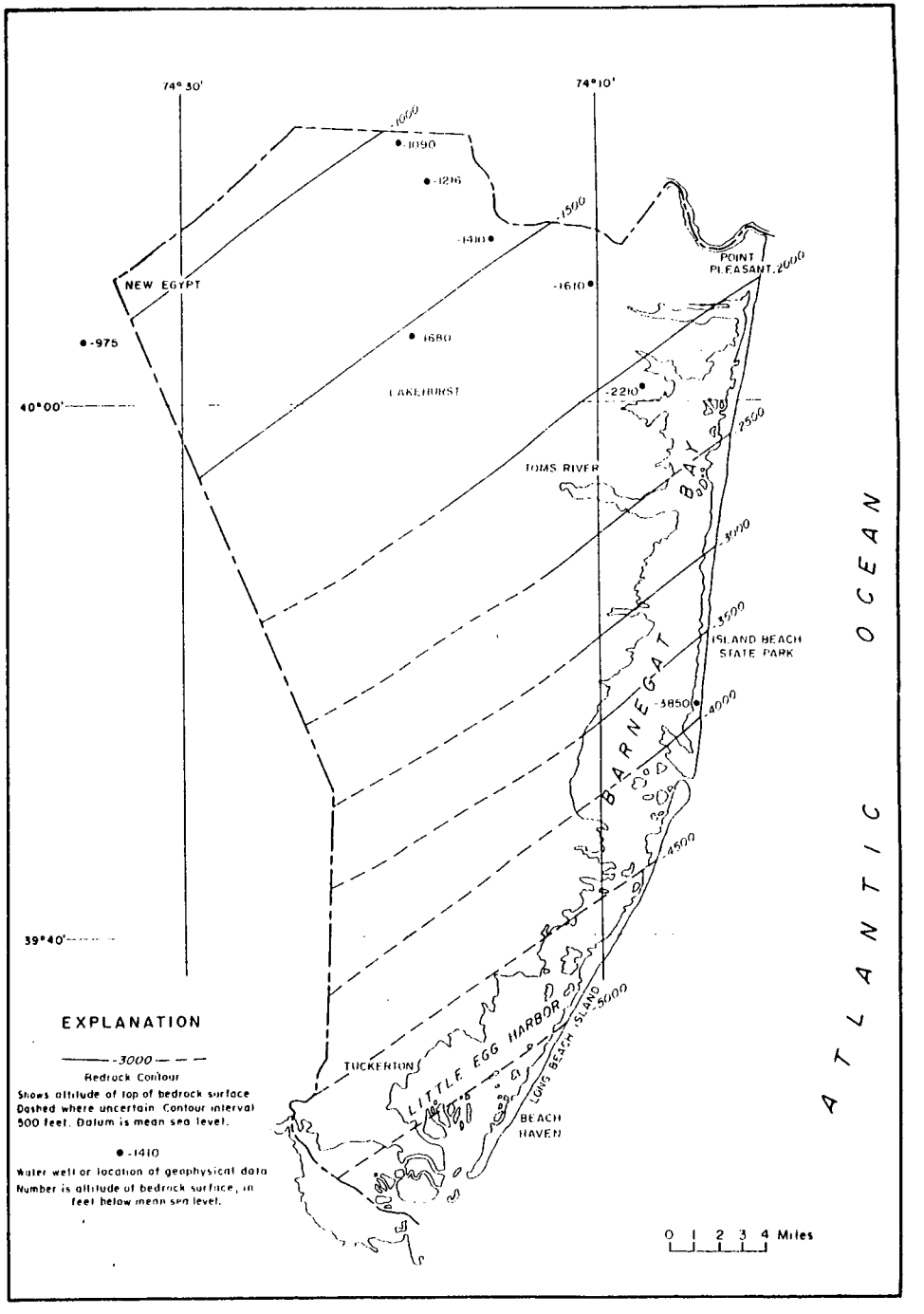


Figure 12.—Configuration of the pre-Cretaceous bedrock surface.

Hydrology

Because the top of the Magothy Formation in Ocean County is more than 600 feet deep, the use of the Raritan and Magothy Formations as a source of ground water is practical only to large industrial and public water-supply companies. This aquifer system contains the largest amount of ground water in storage in the Coastal Plain in Ocean County. It is comparatively undeveloped and, therefore, is an important future source of ground water in the county. At present, wells withdraw more than 5 mgd from the Raritan and Magothy Formations. Most of this is pumped by the Glidden Company near Lakehurst.

At least two aquifers occur within the aquifer system, but more test-well data are needed to determine the exact number and hydraulic relationship of these aquifers. The public water-supply wells (table 7) near the coast in Ocean County utilize only the upper aquifer, whereas three water-bearing zones are tapped near Lakehurst and at Sandy Hook in northeastern Monmouth County (fig. 9). At Lakehurst, the full 900-foot sequence of the Raritan and Magothy Formations was penetrated by wells (grid number 29.41.1.5.2) belonging to the Glidden Company. The water-bearing zones are the upper aquifer from 850 to 970 feet; the most productive aquifer from 1,280 to 1,480 feet; and the least productive aquifer immediately above the bedrock at 1,600 to 1,728 feet below land surface. The land surface is about 95 feet above sea level. Static water levels in the three aquifers before development in March 1962 were at or near sea level. After 15 months of pumping from the three aquifers at about 5 mgd, static water levels declined 20 feet in the upper and middle aquifers and 35 feet in the basal aquifer. The water-level difference suggests that the basal aquifer is hydraulically separate from the upper two, which appear interconnected.

An observation well at Island Beach State Park (33.13.8.7.2), drilled to bedrock, 3,886 feet deep, is screened from 2,736 to 2,757 feet in the middle of the Raritan and Magothy Formations. The well flowed about 6 gpm (September 1962) and had a static head of 28 feet above mean sea level.

The yields of wells tapping the Raritan and Magothy Formations range from 35 to 1,850 gpm and the average is 660 gpm. The average specific capacity is 20 gpm per foot (table 7).

The locations of selected wells tapping the Raritan and Magothy Formations and other aquifers in Ocean County are shown in figure 13.

Recharge to the aquifers occurs from precipitation, mainly in the high-level intake area from Trenton in southern Mercer County northeast to

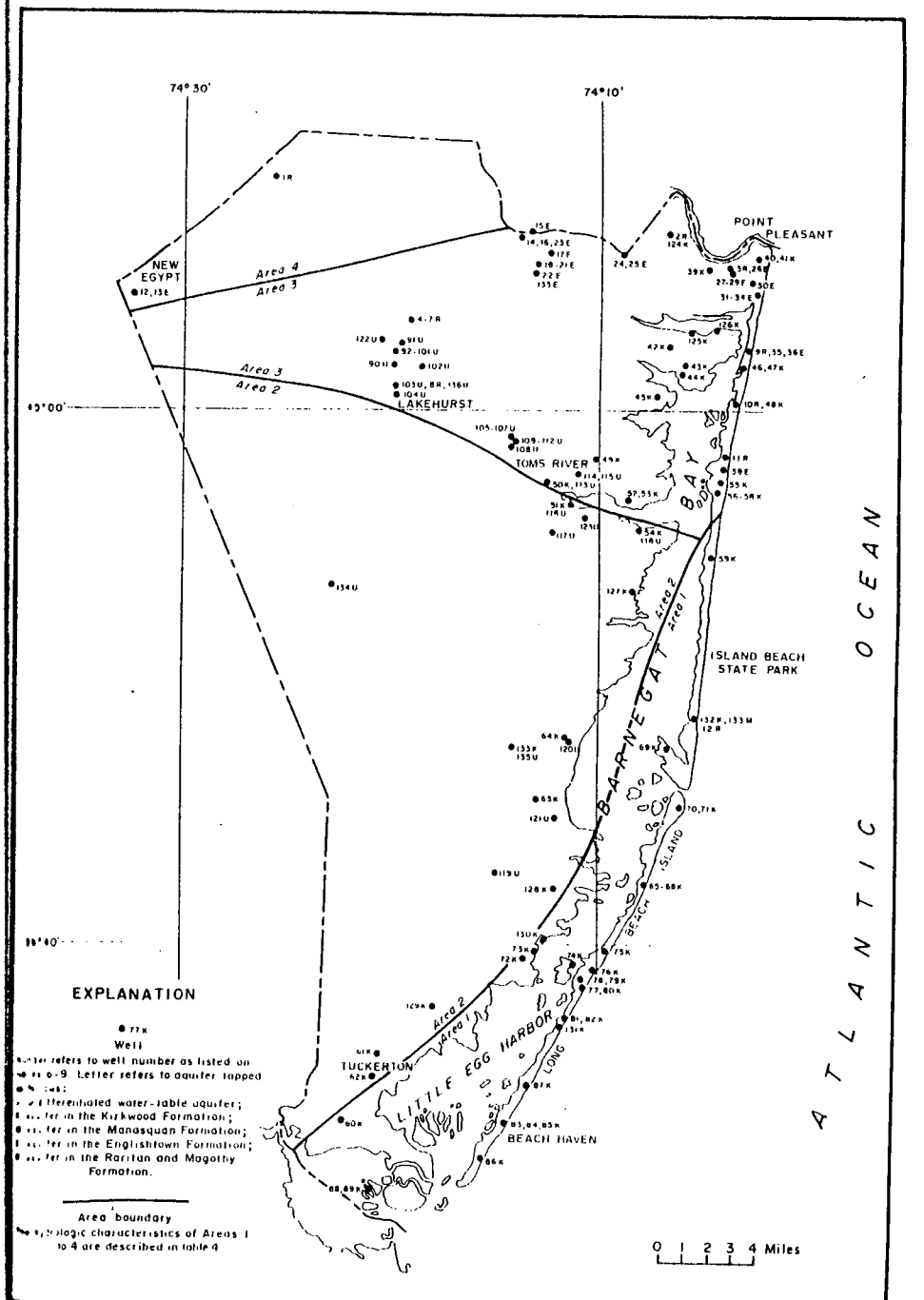


Figure 13.—Map showing location of selected wells in Ocean County.

Metuchen in northern Middlesex Counties (Barksdale and others, 1958, p. 102). An estimated 155 mgd or 1 mgd per sq mi is recharged to the Raritan and Magothy Formations in the intake area. If this quantity is distributed over the area where the Raritan and Magothy Formations contain fresh water (about half of the 4,400 square mile Coastal Plain) an average of 70,000 gpd (gallons per day) per square mile is available. In Ocean County, present withdrawals from the Raritan and Magothy Formations average only about 10,000 gallons per square mile. Withdrawals from the aquifer system in other areas may decrease the amount of water available in Ocean County to less than 70,000 gpd per square mile.

In northern Ocean County, small amounts of water probably discharge through vertical leakage into the Englishtown Formation, which has a lower piezometric head than the Raritan and Magothy Formations in this area. Additional development of the Raritan and Magothy Formations would reduce the amount of leakage from this aquifer to the Englishtown Formation.

Quality of Water

Fresh water in the Raritan and Magothy Formations is soft (28 to 51 ppm hardness) and generally of good quality except for high iron concentrations (0.66 to 3.2 ppm) (table 6). The temperature of the water is from 75°F to 86°F. The water is slightly basic (pH 7.3 to 7.8).

According to Barksdale and others (1958), the salt water-fresh water interface zone in the Raritan and Magothy Formations trends through the Island Beach State Park area. Electric logs and quality-of-water analyses (chloride concentrations of 700-1,000 ppm) indicate that the Island Beach well is screened near the top of the salt water-fresh water interface. Salinity increases below 2,750 feet as shown by the increase in conductivity and negative spontaneous potential and the decrease in resistivity on the geophysical logs (fig. 10). In the southern third of Ocean County, all aquifers in the Raritan and Magothy Formations probably contain saline water.

MERCHANTVILLE FORMATION AND WOODBURY CLAY

Geology

Merchantville Formation

The Merchantville Formation overlies the Magothy Formation disconformably. It is a black or dark green fossiliferous, glauconitic, micaceous clay, silt, or sandy clay which is locally indurated. The Merchantville can be distinguished from the overlying Woodbury Clay by the high glauconite content of the Merchantville and the sparsity or absence of glauconite from the Woodbury and by paleontological evidence. The Merchantville Formation contains a marine fauna, primarily a *Cucullaea* suite (Weller, 1907), which suggests deposition in a shallow water marine environment. Littoral and terrestial sediments of the Merchantville Formation were probably present northwest of the outcrop, but have since been eroded. The formation thickens southwestward along the outcrop from 35 feet in Monmouth County to 60 feet in Salem County.

Woodbury Clay

In the outcrop area, the Merchantville Formation grades upward into the Woodbury Clay (Owens and Minard, 1960). The Woodbury Clay is characteristically a 50-foot thick dark-gray or black non-glauconitic, lignitic, fossiliferous blocky clay containing interbedded white sand lenses. Downdip beneath Ocean County, the unit tends to contain more glauconite clayey sand. The Woodbury Clay and Merchantville Formation as a unit ranges in thickness from 160 feet at Lakehurst to 250 feet thick downdip at Lavallette. At Butler Place in Burlington County the Woodbury Clay is 130 feet thick. The predominant clay minerals determined by Groot and Glass (1960) from outcrop samples are kaolinite, chlorite, and mica which are indicative of non-marine deposition. Downdip montmorillonite, glauconite, and marine fossils were found in well samples suggesting a change to a marine facies.

Hydrology

The Woodbury Clay and Merchantville Formation are relatively impermeable compared to the underlying Raritan and Magothy Formations and the overlying Englishtown Formation and act as a confining layer for these aquifers. No recorded wells in the county tap the Merchantville or Woodbury Formations.

ENGLISHTOWN FORMATION

Geology

The Englishtown Formation is a gray micaceous quartz sand that weathers white, yellow, or brown. It is locally cross bedded and contains cemented iron-oxide, lignite, pyrite, and clay lenses. Near Trenton, in Mercer County, where the Englishtown Formation crops out, it contains feldspar and is defined as a subgraywacke (Owens and others, 1961). Downdip, in the southern part of the county, the sand facies of the Englishtown Formation wedges out or grades into a clayey lithology

resembling the overlying Marshalltown and underlying Woodbury Formations.

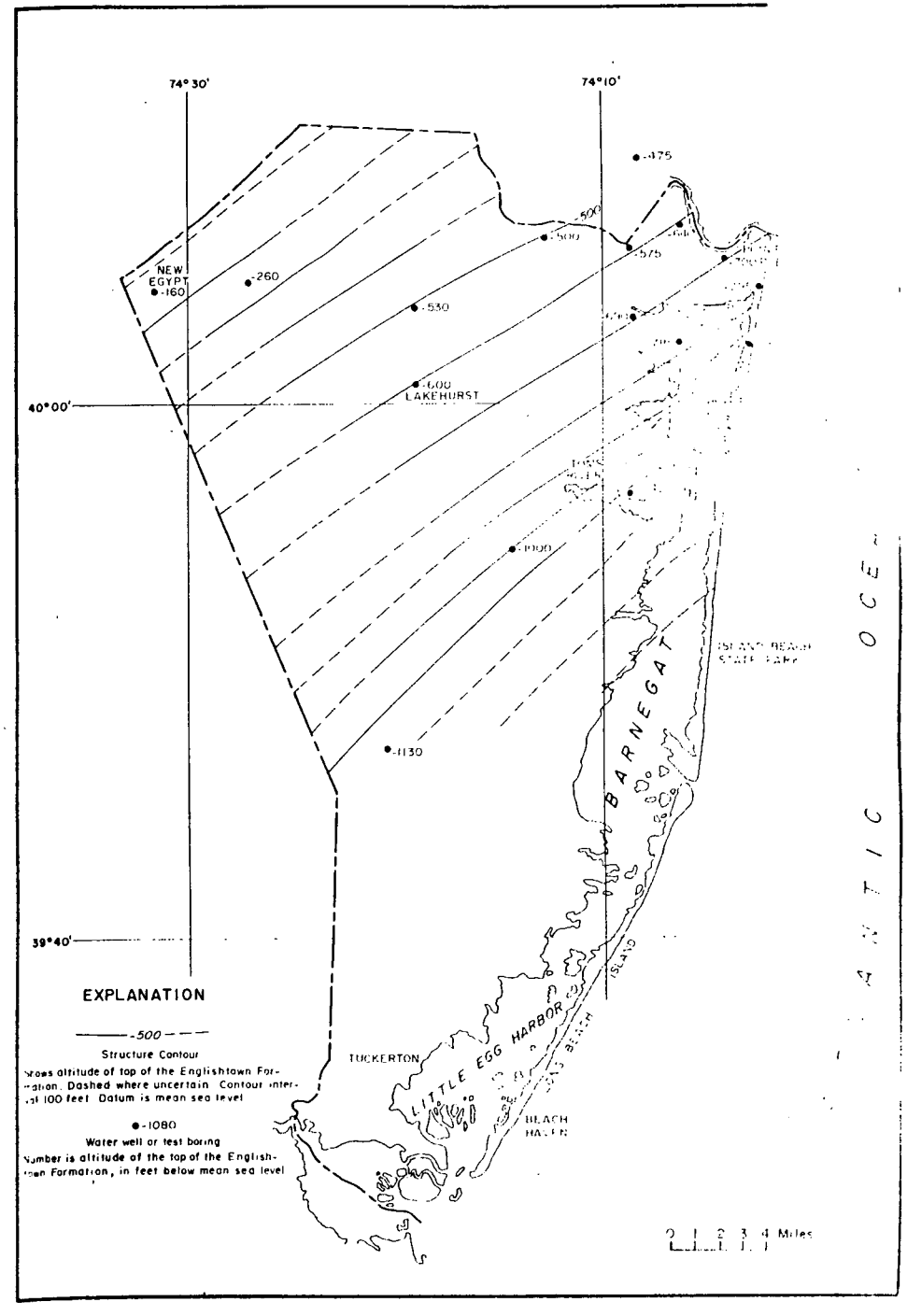
Clay in the Englishtown Formation in the outcrop area is predominantly kaolinite, which is generally considered to be characteristic of continental deposition, but minor amounts of illite are also present (Groot and Glass, 1960). Downdip from the outcrop area, montmorillonite and illite clays are found; the former is considered indicative of marine deposition. Seaber (1962) considered the sandy facies of the Englishtown Formation to represent a delta and beach sand deposit. The sand was probably transported from a northern source area and reworked by longshore currents into the highly sorted fine sands and silts characteristic of the formation. The glauconitic clay facies, which is the downdip equivalent of the sand facies, was deposited in a deeper water marine environment.

The top of the aquifer or sandy facies of the Englishtown Formation has a strike of N. 50° E. and dips 50 feet per mile to the southeast in Ocean County. A structure contour map of the Englishtown Formation in Ocean County is shown in figure 14. The sandy facies of the Englishtown Formation has a thickness of approximately 75 feet in northeastern Ocean County. It thins southward and is considered to be absent at Island Beach State Park (Seaber and Vecchioli, 1963, p. B103).

Hydrology

The Englishtown Formation is fourth in importance in quantity of water yielded in Ocean County. The major users, public water-supply companies (table 8), pump approximately 3 mgd from this formation in Ocean County. The hydrologic characteristics of this artesian aquifer can be summarized from an aquifer study by Seaber (1962). Recharge to the formation occurs predominantly from vertical leakage down through the overlying younger formations in the topographic high areas of Monmouth and Camden Counties, 5 to 10 miles southeast of the Englishtown outcrop area.

The most intensive development of this aquifer is in the coastal areas of Monmouth County and northeastern Ocean County where pumping has lowered static water levels as much as 145 feet (at Allaire State Park in southeastern Monmouth County) from 1910 to 1967. Water levels at Allaire State Park declined 27.4 feet from April 1964 to April 1967. As water levels in the Englishtown Formation in this area are lower than in either the Kirkwood, Raritan, or Magothy Formations, water may leak vertically into the Englishtown from these formations. However, continued decline in water levels in observation wells tapping the Englishtown Formation indicates that much of the yield of wells is



coming from storage. Water levels in an observation well at Colliers Mills have declined approximately 30 feet from 1910 to 1967 and 5 feet from April 1964 to April 1967. Water levels in an observation well at Toms River have declined approximately 90 feet from 1910 to 1967 and 2 feet from April 1966 to April 1967.

Analysis of the pumping phase of a pumping test at Lakewood (Seaber, 1962) in May 1959 indicated a coefficient of transmissibility of 10,000 gpd/ft and a coefficient of storage of 2.7×10^{-4} for the Englishtown Formation, which is 52 feet thick there. From the recovery phase of this test, the coefficient of transmissibility calculated was 16,000 gpd/ft, and the coefficient of storage was 2.0×10^{-4}. The computed average permeability was about 300 gpd/ft^2. Laboratory analyses of permeability for 10 sand samples from the Englishtown outcrop ranged from 90 to 500 and averaged 273 gpd/ft^2 (Seaber, 1962).

Reported yields of wells in the Englishtown Formation range from 19 to 503 gpm and the average is 260 gpm (table 8). Specific capacities range from 1 to 5 gpm per ft and the average specific capacity is 3 gpm per ft.

Quality of Water

Ground water in the Englishtown Formation requires no special treatment for most industrial or public-supply uses. The water is soft to moderately hard (30 to 82 ppm hardness) and the pH ranges from 7.5 to 8.3. The composition of ground water changes downdip from a calcium-sodium hydrochemical facies to a sodium-calcium facies, as a result of ion exchange and adsorption of calcium by lignite (Seaber, 1962, p. B30). Changes in sodium, bicarbonate, nitrate, and temperature occur locally in addition to the expected downdip change of hydrochemical facies. Along the coast of Ocean County, high concentrations of sodium, bicarbonate, and total dissolved solids are common. No significant changes in the chemistry of the water have occurred with time in Ocean County. Chemical analyses from Englishtown wells are included in table 6.

The aquifer in the Englishtown Formation has little potential for further ground-water development mainly because water levels are already far below altitudes at which sea-water intrusion could occur. However, there is no evidence that sea water has intruded the aquifer.

MARSHALLTOWN FORMATION

Geology

The Marshalltown Formation varies in lithology from a black sandy micaceous glauconite clay to a clayey greensand. In the outcrop area in Monmouth County, a laminated micaceous clay with [illegible] scattered glauconite predominates, whereas toward the southwest [illegible] glauconite sands are characteristic. Lignite is abundant in the basal part of the formation but decreases upward. Chlorite is abundant throughout the formation near Trenton in southern Mercer County (Owens and Minard, 1960). Downdip from the outcrop area, the formation coarsens somewhat into clayey silts and sands similar to the downdip lithology of the overlying Wenonah Formation and Mount Laurel Sand. The abundance of glauconite distinguishes the Marshalltown from the overlying and underlying formations. It is differentiated in electric and gamma-ray logs from the overlying and underlying aquifers by its low self potential and resistivity response and its strong gamma-ray response.

The Marshalltown Formation is typically 10 to 20 feet thick and attains a maximum thickness of about 25 feet in New Jersey.

The formation was deposited in a shallow-water marine environment. It contains a predominantly *Cucullaea* and *Exogyra ponderosa* fauna. *Exogyra ponderosa* is the characteristic index fossil (Weller, 1907) as it is restricted in New Jersey to this formation.

Hydrology

In general, the Marshalltown is considered a confining bed for the underlying Englishtown and overlying Wenonah and Mount Laurel aquifers. Downdip, in the southern half of Ocean County, the aquifers of the Englishtown and Wenonah and Mount Laurel Formations pinch out or become clayey and form part of the aquitard system which lies between the Magothy and Kirkwood Formations. Although no wells are reported to tap this formation in Ocean County, yields of 40 gpm to domestic wells have been obtained from the more sandy phases of the formation in other areas of the State (Barksdale and others, 1958).

WENONAH FORMATION AND MOUNT LAUREL SAND

Geology

Wenonah Formation

The Wenonah Formation, which does not crop out in Ocean County, is typically a silt to medium-grained, yellow micaceous, and chloritic sand. It thins in outcrop from 100 feet in Salem County to less than 40 feet in the Atlantic Highlands in northeastern Monmouth County and generally becomes finer grained and more micaceous to the northeast. Locally, the formation is distinctly laminated with thin black clays and indurated ferruginous sandstone beds. Lignite and traces of glauconite also are present. In the subsurface beneath Ocean County, the Wenonah Forma-

Quality of Water

The quality of ground water from the Kirkwood aquifer is suitable for most uses. It is generally soft to moderately hard (2.9 to 105 ppm except one sample with 269 ppm hardness) and is low in dissolved solids content (40 to 180 ppm except one sample with 688 ppm). Locally, excessive concentrations of iron (0.04 to 7.2 ppm) and acidic water (pH 4.0 to 8.3) are encountered (table 6). In the Point Pleasant area where the Kirkwood crops out, salt water was found in one well (No. 48K). The temperature of ground water in the Kirkwood is lower than 62°F, which makes it suitable for cooling purposes. The quality of ground water in the Kirkwood is similar to that of the water-table aquifer except that the water from the Kirkwood contains more silica (range 15-32 ppm), than the unconfined water (range 2.8 to 5.8 ppm except one sample with 17 ppm).

THE WATER-TABLE AQUIFER

Geology

Cohansey Sand

The Cohansey Sand is exposed throughout Ocean County (fig. 7) except along the north and east borders. It is characteristically a yellowish-brown, unfossiliferous, cross-stratified, pebbly, ilmenitic, fine- to very coarse-grained quartz sand that is locally cemented with iron oxide. White, dark gray, and red kaolinitic clays are interbedded with the sands. Individual beds are difficult to trace as the clays and sands are lenticular and discontinuous. Generally at any one site several sand and clay beds are found. The clay beds are 8 to 10 feet thick but may be as much as 30 feet thick. According to Minard and Owens (1962), clay and silt eluviated from overlying Quaternary deposits have caused the upper beds of the Cohansey Sand to become less porous and permeable.

Markewicz and others (1958) believe the Cohansey to be a large alluvial fan deposit, whereas Owens and Minard (1960) postulate a beach origin and consider the formation too widespread for alluvial deposition. The yellow-brown color suggests deposition in an oxidizing environment such as terrestrial or near shore marine. However, oxidation may be from post-depositional weathering.

The Cohansey Sand is of Miocene(?) and Pliocene(?) age. Poorly preserved plant fossils found near Bridgeton in west-central Cumberland County are correlated with European flora of late Miocene age.

The Cohansey thickens southward to about 200 feet at Tuckerton. The base of the formation dips about 10 feet per mile southeastward.

Beacon Hill Gravel

The Beacon Hill Gravel of Pliocene(?) age occurs as erosional remnants capping hilltops in the western part of Ocean County. (See fig. 7.) It is the oldest, highest in altitude, and coarsest of the gravel deposits in the county. It is composed of quartz, chert and rock fragment pebbles, and sand.

Bridgeton Formation

The Bridgeton gravel of Pleistocene age is divided into the Glassboro phase found in the southwestern part of New Jersey and the Woodmansie phase found in Ocean County (Salisbury and Knapp, 1917). The Woodmansie phase forms scattered veneers on hilltops in the northern and southern sections of the county and consists chiefly of sand derived from the Kirkwood and Cohansey Formations. It was deposited on a southeast sloping plain that ranges in altitude from 130 feet at Lakewood to 60 feet at Barnegat (fig. 3). The deposit is about 20 feet thick. Southward at lower elevations more ironstone and less weathered chert is present. It differs from the Glassboro phase in that it is non-arkosic and without pebbles of crystalline rock, red shale, or sandstone derived from the Piedmont Plateau province.

Pensauken Formation

The Pensauken Formation is similar in lithology to the Bridgeton Formation but occurs mainly in the Toms River area. It is slightly glauconitic and contains abundant ironstone fragments. Toward the southeast, the quartz pebble content increases. The Pensauken Formation differs from the Cape May Formation in the greater amount of cementation, oxidation of the glauconite grains, higher percentage of iron oxide grains and greater weathering of the chert of the Pensauken (Salisbury and Knapp, 1917). Pebbles or boulders of granite, Triassic red shale and sandstone, and Paleozoic quartzites from a northwest origin are absent from the Pensauken Formation.

Cape May Formation

The Cape May Formation of Pleistocene age is a terrace and marine deposit found at altitudes of less than 50 feet along the coast and as high as 150 feet in inland stream valleys. The marine phase is found along the coast and fluvial deposits occur in stream valleys. In general, the Cape May Formation is less compact and contains fewer weathered chert and iron oxide coated pebbles than the older gravels. Much of the Cape May Formation is material reworked from older deposits. In the marine phase of the Cape May, a thin shallow black-clay bed occurs commonly in tidal inlet areas such as at Toms River.

Holocene Series

Holocene deposits consist of dune and related beach deposits, swamp and tidal marsh deposits, and stream alluvium. Dune and related beach deposits form the barrier beach extending from Beach Haven to Point Pleasant. The sediments are typically well sorted, fine- to medium-grained quartz sands and are usually less than 50 feet thick.

Silt and clay that are high in organic matter compose the swamp and salt-marsh deposits. Cedar swamps are found inland near streams in Ocean County and salt marshes are common to the Barnegat Bay area.

Stream alluvium consists of thin sand deposits confined to stream channels.

Hydrology

The water-table aquifer is composed of the Cohansey Sand, the Beacon Hill Gravel, and the Bridgeton, Pensauken, and Cape May Formations. It is important as a future source of ground water. At present, the water-table aquifer is pumped moderately in the vicinity of Toms River and Lakehurst and to a lesser extent along the bayside coast of Ocean County. Locally, the water-table aquifer contains confined beds along the coast. Wells along the coast obtaining water from below a thin black clay bed of the Cape May Formation are artesian and commonly flow. In this area, artesian heads in the Kirkwood Formation are higher than the water table (fig. 18) so water is discharged upward into the water-table aquifer. In the pinelands area, where large quantities of water are in storage, the aquifer is virtually untapped (fig. 13).

Recharge to the water-table aquifer in Ocean County is directly from precipitation although locally, recharge can be induced from nearby streams. The depth to the water table in most of the county can be estimated from the altitude of nearby streams that are hydraulically connected and fed by the water-table aquifer. Figure 19 is a water-table map compiled largely from surface-water altitude data. In general, the depth of the water table below land surface is greatest where the altitude of the land is highest.

The outcrop area of this aquifer and recharge to it are the largest of the Coastal Plain aquifers. The water-table aquifer is also most affected by losses from evapotranspiration and baseflow runoff. As much as 50 percent of the precipitation is transpired by the pine-oak-cedar forest and evaporated from cranberry bogs, cedar swamps, lakes, streams, and shallow water-table areas. At least 70 percent of stream water flowing to the ocean is ground-water baseflow derived from this aquifer. Ground-water

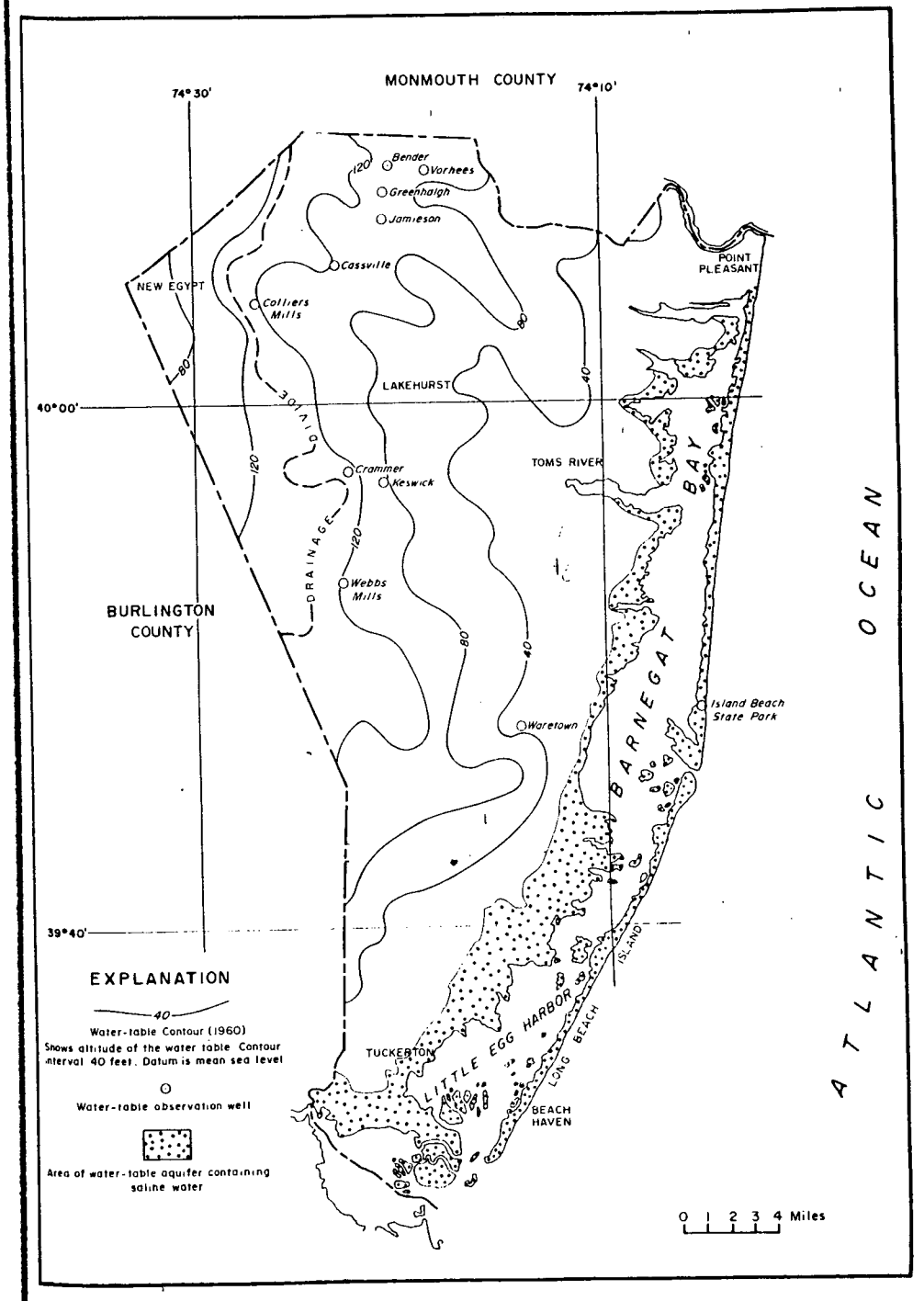


Figure 19.—Water table contour map of Ocean County.

baseflow from this aquifer in the Toms River drainage basin is approximately 0.8 mgd per sq mi or 100 mgd for the total basin area. This is about 80 times the present daily pumpage from the aquifer in Ocean County.

In the southern half of Ocean County, the water-table aquifer and the Kirkwood Formation are the only sources of fresh ground water. Here, the Raritan and Magothy Formations contain saline water, and aquifers of the Englishtown, Mount Laurel, Wenonah, and Vincentown are absent. The Kirkwood is intensely developed along the coast, particularly on the barrier beach, as indicated by water levels that are below sea level. Inland, the Kirkwood yields only small quantities of water. Hence, the water-table aquifer is the most important future source of fresh ground water in the southern part of the county.

In the areas of concentrated pumpage, at Toms River and Lakehurst, yields of 30 industrial and public-supply wells tapping the water-table aquifer (table 10) range from 65 to 665 gpm and the average is 323 gpm. Specific capacities range from 2 to 39 gpm per ft and the average is 13 gpm per ft. The coefficient of transmissibilty computed from an infiltration gallery aquifer test near Toms River is 28,400 gpd per ft. Permeabilities determined in the U. S. Geological Survey laboratory of sands and gravels in the water-table aquifer range from less than 1 to about 4,500 gpd per sq ft (table 5).

The Cohansey Sand is the thickest formation and constitutes most of the zone of saturation in the water-table aquifer. The overlying deposits of the Beacon Hill Gravel, Bridgeton, Pensauken, and Cape May Formations act primarily as permeable receptors of precipitation for recharge to the zone of saturation. Most of the units overlying the Cohansey Sand are above the water table, but locally, along the coast, and in stream valleys parts are saturated. The salt marsh and swamp deposits of Holocene age are relatively impermeable. The beach sands contain mostly saline water.

About 4 mgd are pumped from the water-table aquifer by industry and public-water supply companies, and about 2.5 mgd are pumped for domestic use. The natural discharge to streams, or base flow, is about 0.8 mgd per sq mi.

Quality of Water

Ground water in the water-table aquifer is commonly acidic (pH 4.4 to 6.7) and therefore corrosive. It may contain excessive iron (0.09 to 22 ppm), and may have a hydrogen sulfide odor. Because of these

Table 5.—Physical characteristics and permeability of sediments exposed in Ocean County. (Locations on fig. 7)
(values are laboratory determinations)

No.	Geologic unit	Median diameter millimeters	Coarsest grade size millimeters	Coefficient of sorting	Skewness	Coefficient of permeability (gpd sq ft Meinzer units)
1	Cohansey Sand	0.24	8 -16	1.67	1.58	110
2	do.	.16	8 -16	2.37	.85	.2
3	do.	.19	2 - +	2.12	1.80	67
4	do.	.21	1 - 2	2.10	1.98	110
5	do.	.65	+ - 8	1.74	1.14	320
6	do.	.23	.5- 1	1.43	1.04	200
7	do.	.66	+ - 8	2.08	1.22	550*
8	do.	1.0	+ - 8	1.70	.87	3,800†
9	do.	1.8	16 -32	1.68	1.03	34
10	do.	.37	- 8	1.35	.92	240
11	do.	.18	• 1	1.52	1.03	30
12	do.	.4	2 - +	1.68	1.09	300
13	do.	.52	2 - +	1.35	1.07	710
14	do.	.7	16 -32	2.00	.82	400
15	do.	.45	+ - 8	2.50	1.30	170
16	do.	.6	8 -16	5.00	1.36	+
17	Beacon Hill Gravel	.44	2 - +	1.65	1.09	400
18	do.	1.1	16 -32	2.76	1.17	110
19	do.	7.0	16 -32	2.50	.29	3,000
20	Pensauken Formation	5.0	16 -32	2.76	.59	1,500
21	do.	2.5	16 -32	4.00	1.44	360
22	Cape May Formation	.33	1 - 2	1.31	1.08	30*

*horizontal †vertical ‡average

characteristics, the water-table aquifer contains the poorest quality fresh water of the Coastal Plain aquifers. It differs in quality from surface water in that it is cooler, less acidic, and does not have the brown color characteristic of the streams. Surface water, however, does not have the hydrogen-sulfide odor and the excessive iron content of the ground water. Table 6 contains chemical analyses of water from water-table wells.

SURFACE WATER

Streamflow in the Coastal Plain consists largely of base flow derived from ground-water discharge. During periods of little or no precipitation, base flow accounts for virtually all the streamflow in Ocean County. The location of stream-gaging stations in Ocean County are shown in figure 3.

A stream hydrograph reflects flow contributions from base flow and from direct runoff and generally can be separated empirically into these components. Following a rainfall, a large part of the stream discharge is direct runoff, and is indicated by a sudden increase in discharge on the hydrograph. After the peak flow passes, the curve decreases rapidly at first, then more gradually as stream discharge becomes entirely base flow. A period of five days after a rainfall are sufficient for direct runoff to be discharged from the Toms River basin. After that time, the hydrograph shows the depletion of the ground-water reservoir.

The period of 5 days for surface runoff to drain from the Toms River basin was determined by relating runoff on the hydrograph to the average daily precipitation at Toms River, Lakewood, and at Pemberton in northern Burlington County for the years 1940-62. The peak discharge of the stream usually occurs 2 to 3 days after a rainfall. Surface runoff terminates about 2.6 days after the peak, according to the formula (Linsley, Kohler, and Paulhus, 1958) $t = A^{0.2}$ where A is the drainage area in square miles of the basin, and t is the time in days after the hydrograph peak.

BASE FLOW

Base flow for Toms River was estimated by separating the hydrograph for the relatively dry water year of 1957 (34 inches precipitation at Toms River) into surface runoff and base flow. The average base flow computed for 1957 was 124 cfs (13.59 inches) or 67 percent of the annual mean streamflow for 1957 of 184 cfs (20.17 inches).

Base flow for Toms River was computed also for the exceptionally wet water year of 1958, when 74 inches of precipitation fell. By the hydrograph separation method, base flow was found to be 202 cfs (22.14 inches) or 68.5 percent of the annual mean streamflow for 1958 of 295 cfs (32.34 inches).

STREAMFLOW

A continuous record of streamflow is available for Toms River (fig. 4) from 1928 to the present. The gaging station at Toms River includes a drainage area of 124 square miles. The average discharge for the [illegible] period is 211 cfs (cubic feet per second), equal to about 23.13 in[illegible]

	Location	Owner's name and well number	N. J. Grid number	Year completed	Altitude above mean sea level (ft)	Depth (ft)	Diameter (in)	Screen setting (ft)	Static water level above (+) or below land surface (feet)	Yield (gpm)	Drawdown (ft)	Specific capacity (gpm ft)	Use of water	Remarks
	New Egypt	New Egypt Water Co. 1	28.33.7.9.9	1907	75	239	6	214- 239	+25	70			P.S.	L., Q. Flowing well. [illegible] level +15' above land surface in Jan. 1959.
[illegible]	New Egypt	New Egypt Water Co. 1	28.33.7.9.9	----	75	238	8	218- 238	----	250	70	4	P.S.	Flowed 90 gpm.
13	Lakewood	Lakewood Water Co. 6	29.32.4.7.4	1960	70	582	12-8	521- 582	93	503	109	5	P.S.	E., G., L.
14	Lakewood	St. Gabriel's Junior College 1	29.32.4.7.3	1957		530	8	510- 530	34	130	166	1	D.	
16	Lakewood	Lakewood Water Co. 5	29.32.4.7.4	1957	40	604	12-8	542- 604	90	500	160	3	P.S.	
17	Lakewood	Lakeshore Laundry 1	29.32.7.3.4	1950	50	612	6	596- 612	50	70	135	1	D.	
18	Lakewood	Lakewood Water Co. 2	29.32.7.5.2	1921	60	625	8	575- 625	+20	300	---	---	P.S.	Q.
19	Lakewood	Laurel in the Pines	29.32.7.5.2	1898	60	606	6						D.	Flowed 20 gpm.
[illegible]	Lakewood		29.32.7.5.2	1898	40	625	3							Flowed 45 gpm.
[illegible]	Lakewood	Lakewood Hotel & Land Assoc.	29.32.7.5.2	1899	30	600	6		+20	200			D.	Flowed 100 gpm.
[illegible]	Lakewood	Lakewood Water Co.	29.32.7.5.2	1900	35	621	6						P.S.	Flowed 60 gpm.
[illegible]	Lakewood	Lakewood Water Co.	29.32.4.7.4	1899	30	600	6		20				P.S.	Flowed 150 gpm.
[illegible]	Parkway Pines	Parkway Water Co. 1	29.32.9.2.5	1958	25	646	8	605- 646	81	179	85	2	P.S.	
[illegible]	Lanes Mills	Parkway Water Co. 2	29.32.9.2.5	1958	35	739	8	647- 688	75	300	125	2	P.S.	L.
	Point Pleasant	Point Pleasant Water Dept. 1	29.33.8.6.6	1936	20	825	10-8	745- 770	30	277	57	5	P.S.	L., Q.
	Point Pleasant	Point Pleasant Water Dept. 3	29.33.9.4.4	1946	15	805	12-10-6	748- 798	56	300	117	3	P.S.	L., Q.
	Point Pleasant	Point Pleasant Water Dept. 2	29.33.9.4.4	1936	15	775	10-8-6	715- 745	34	265	83	3	P.S.	
	Point Pleasant	Point Pleasant Water Dept.	29.33.9.4.4	1893	10	806		746- 806	+35					Flowed 45 gpm.
	Bay Head	Central Railroad of N. J.	29.33.9.8.2	1930	9	813	8-5	793- 813	20	250	65	4	D.	
	Bay Head		29.33.9.8.9	1902	10	870	6							Flowed 100 gpm.
	Bay Head		29.33.9.8.9	1896	10	813	4.5-3		+35					Flowed 85 gpm.
	[illegible] Head	Ocean County Water Co. 5	29.33.9.8.9	1947	10	834	10-8, 6-3	775- 834	64	220	75	3	P.S.	L., Q.
	[illegible] Head	Ocean County Water Co. 6	29.33.9.8.9	1950	10	818	10-8	778- 818	104	338	139	2	P.S.	L., Q.
	Manitoloking	Ocean City Water Co. 6	29.43.3.8.7	1955	10	1,052	12-8	844- 906	58	230	230	1.0	P.S.	E., L., Q.
	Manitoloking	Ocean City Water Co. 4	29.43.3.8.7	1924		922			+42					Flowed 60 gpm.
	[illegible] Beach	Normandie Beach Water Works 1	33.3.3.1.1	Prior 1929	3	1,038	8-4.5		+8.5	19	23.5	1	P.S.	Flowed 7 gpm.
	Lavallette	Lavallette Water Dept. 3	33.3.5.3.4	1948	7	1,180	12-8	1,120-1,180	58	500	240	2	P.S.	L., Q.

REFERENCE #9

DRAFT

GRAPHICAL EXPOSURE MODELING SYSTEM

(GEMS)

USER'S GUIDE

Prepared for:

U.S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF PESTICIDES AND TOXIC SUBSTANCES
EXPOSURE EVALUATION DIVISION
Task No. 4
Contract No. 68016618
William Wood - Project Officer
Loren Hall - Task Manager

Prepared by:

GENERAL SOFTWARE CORPORATION
8401 Corporate Drive
Landover, Maryland 20785

Submitted: June 25, 1984

Geoecology Data Base (Selected Files)	This dataset contains county level data on the following environmental parameters: agriculture, climate, vegetation, forestry, air quality, land, natural areas, population, water quality, terrain (soils) and wildlife.
GAGE	The GAGE dataset contains primarily stream flow rates monitored consistently by approximately 99,500 stream gaging stations throughout the country, and some estimated flows.
IFDDIR	IFDDIR contains industrial facility data for approximately 28,000 direct dischargers excluding publicly owned treatment works (POTWs)
IFDIND	IFDIND contains limited industrial facility data for approximately 12,000 indirect dischargers which discharge through other facilities, usually POTWs.
Master Area Reference File (MARF) 1980 census	This dataset contains a variety of location identification information, population count by race, the number of occupied and owner-occupied

TABLE 2-2. GEMS Datasets (Continued)

DATASET NAME	DESCRIPTION
	number of families for all the enumeration district/block groups for continental USA, Hawaii, and Alaska.
Meteorological Data	Several meteorological data files are contained in this category: (1) the Stability Tabular Array (STAR) data file has meteorological data for 394 first order weather stations in the continental USA, (2) A master index file (STARSEL), and (3) An auxiliary file (AUX).
Publicly Owned Treatment Works (POTWs)	This dataset contains 1982 survey data on the unit treatment process, the influent and effluent and hour rates, and the population served by 33,000 publicly owned treatment works around the country.

Enter GO to begin processing
? GO

Data List of Dataset: NJ71 Number of Records = 6

REC #	POP	HOUSE	DISTANCE	SECTOR
1	0	0	0.400000	1
2	0	0	0.810000	1
3	1606	536	1.60000	1
4	11186	5619	3.20000	1
5	23052	8253	4.80000	1
6	39638	16395	6.40000	1

Press RETURN to page forward, enter Pnnn to position the starting record of the next page, enter BACK to reselect variables, or enter END to stop
?

REFERENCE #10

NUS CORPORATION — **TELECON NOTE**

CONTROL NO:	DATE:	TIME:
02-8403-109A	7/2/86	1400

DISTRIBUTION:

BETWEEN:	OF:	PHONE:
Mr. Chiapetta	NJ Water Co. South Lakewood	(201) 363-3142

AND: Daniel Caracciolo (NUS)

DISCUSSION:

Information on wells in the area and population they serve.

NJ Water works is part of American water works and serves 27,780 people with 6062 connections. ~~Wells are~~ In the vicinity of site is one ~~Englishtown~~ "well #7" which taps the Englishtown formation at 757'. It was drilled in 1964. Company has 4 other Englishtown Formation wells and one Raritan-Magothy Formation well. However, these wells are outside of area of concern according to Mr. Chiapetta. All wells are part of an integrated system. Wells are sampled monthly for drinking standards and appear to be fine.

ACTION ITEMS:

REFERENCE #11

NUS CORPORATION — **TELECON NOTE**

CONTROL NO:	DATE:	TIME:
02-8403-109A	2/1/86	~~09~~ 1400

DISTRIBUTION:

BETWEEN:	OF:	PHONE:
Mr. Hennewell	NJDEP	(609) 292-7219

AND: (NUS)

DISCUSSION:

Information on closest municipal well.

Well is "Well #5" of Lakewood Water Dept. Well is 80' deep and installed in 1972. A deeper Englishtown test hole was drilled in 1957 but does not appear to have ever been developed. The current well taps the Eschansey aquifer.

ACTION ITEMS:

NUS 067 REVISED 0581

REFERENCE #12

NUS CORPORATION — **TELECON NOTE**

CONTROL NO:	DATE:	TIME:
02-8403-109A	7/2/86	1415

DISTRIBUTION:

BETWEEN:	OF:	PHONE:
H Shaiman	S. Lakewood Water ~~Company~~	(201) 363-4422

AND: Daniel Caramagno (NUS)

DISCUSSION:

Wells and who they serve.

S. Lakewood Water serves slightly more than 10 000 people using an ~~sys~~ integrated system of wells.

Closest well is between ½ mile to a mile and is 80 feet deep in the Cohansey formation. Between one and two miles are Englishtown and Raritan Magothy wells.

ACTION ITEMS:

REFERENCE #13

NUS CORPORATION — **TELECON NOTE**

CONTROL NO:	DATE:	TIME:
02-8403-109A	7/2/86	0915

DISTRIBUTION:

BETWEEN:	OF:	PHONE:
Mr Hayton	NJDEP Bureau Site Inv	(609) 633-2210

AND: D. Caramagno (NUS)

DISCUSSION:

Information ~~of~~ on DEP studies at old Lakewood LF

No study was done because NUS did one. Mr Guy Tamarano of NJDEP/DWR is permitting for monitoring wells. His number is (609) 292-0424

P.S. Area is known for high iron. No record of enforcement on site exists or site was closed before laws were passed. There was a walkover survey of the site and leachate and ponded areas did not look good to DEP officials. No regulatory history as site was closed before major legislation concerning solid waste was passed. As municipal LF it is unlined + uncapped. Some unconfirmed reports of chemical dumping.

ACTION ITEMS:

REFERENCE #14

NUS CORPORATION — **TELECON NOTE**

CONTROL NO:	DATE:	TIME:
	6/1/84	1030 AM

DISTRIBUTION:

BETWEEN:	OF:	PHONE:
Bill Caffey's assistant	NJDEP Bureau of ~~Potable~~ Water	609 (~~215~~) 293-5550

AND: Jerry Cirilli (NUS)

DISCUSSION:

Returned call with sampling results of groundwater samples taken March 4, 1981. They were testing for heavy metals and volatile organics. Five private wells were sampled. These ranged in depths from 30-50 feet. Two samples from each hole for the 2 types of analyses. The samples were taken from nearby residences. Only 1 sample yielded anything above the detectable level. This sample, from 716 Coral Street, yielded 15.1 ppb of 1,1,1-Trichloroethane.

ACTION ITEMS:

REFERENCE #15

NUS CORPORATION — **TELECON NOTE**

CONTROL NO:	DATE:	TIME:
02-8403-109A	7/1/86	1140

DISTRIBUTION:

BETWEEN:	OF:	PHONE:
Shirley Dubnik	Agricultural Extension Service / Ocean County	(201) 349-1275

AND: Daniel Caramagno (NUS)

DISCUSSION:

Farms currently exiting in the area:

- Beyond Two miles NE is the Ocallette Farm of vegetables. They have an irrigation pond but no wells. (@ Lanes Mill and Joe Parker Rd.)
- Cranberry bogs in area no longer exist as pollution from sewage may have contaminated the water. Owner (Ed Libman) sold bogs to county.
- A horse farm and pig farm were in the area but they are now inactive.

ACTION ITEMS:

REFERENCE # 16

TABLE 1

Sample Descriptions
Lakewood Township Landfill
Lakewood, New Jersey
NUS Case #NJ71

Sample Number	Sample Type	Federal Express Airbill Number	Time	Location
SW-1	Organic Aqueous Inorganic Aqueous	718394810 718394821	1345	Cedar Creek on West side of site.
SED-1	Organic Sediment Inorganic Sediment	718394810 718394821	1350	Same location as SW-1.
SOIL-1	Organic Soil Inorganic Soil	718394810 718394821	1410	Discolored soil along dried up section of East side of Cedar Creek.
SOIL-2	Organic Soil Inorganic Soil	718394810 718394821	1415	Same locaton as SOIL-1.
SW-2	Organic Aqueous Inorganic Aqueous	718394810 718394821	1430	Cedar Creek near sand piles.
SED-2	Organic Sediment Inorganic Sediment	718394810 718394821	1435	Same location as SW-2.
GW-2	Organic Aqueous Inorganic Aqueous	718394810 718394821	1500	Well on site near New Hampshire Ave.
GW-1	Organic Aqueous Inorganic Aqueous	718394810 718394821	1600	Private residence near site on E. Spruce Street
WB-1	Organic Aqueous[a] Inorganic Aqueous	718394810 718394821	N/A[b]	Aqueous blank.
SB-1	Organic Soil[c] Inorganic Soil	718394810 718394821	N/A[b]	Soil blank.

NOTES:

(a) Organic and inorganic aqueous blanks contained doubly deionized distilled water taken from EPA, Edison, N.J. on 8/29/84.

(b) N/A = Not Applicable.

(c) Organic and inorganic soil/sediment blanks contained doubly deionized distilled wate taken from EPA, Edison, N.J. on 8/29/84.

INORGANIC DATA QUALIFIER

Footnotes:

NR - not required by contract at this time.

Form I:

Value - If the result is a value greater than or equal to the instrument detection limit but less than the contract required detection limit, report the value in brackets (i.e., [10]. Indicate the analytical method used with P (for ICP/Flame AA) or F (for furnace).

U - Indicates elemant was analyzed for but not detected. Report with the detection limit value (e.g., 10U).

E - Indicates a value estimated or not reported due to the presence of interference. Explanatory note included on cover page.

S - Indicates value determined by Method of Standard Addition.

R - Indicates spike sample recovery is not within control limits.

* - Indicates duplicate analysis in not within control limits.

+ - Indicates the correlation coefficient for method of standard addition is less than 0.995

LAKEWOOD
TOWNSHIP
L 12

USEPA Contract Laboratory Program
Sample Management Office
P.O. Box 818 — Alexandria, Virginia 22313
703/557-2490 FTS 8-557-2490

Sample No.
NJ-71-GW-1

INORGANICS ANALYSIS DATA SHEET

LAB NAME N.U.S Corp / S.C.O. CASE NO. NJ 71

LAB SAMPLE ID. NO. 24081644 QC REPORT NO. N.A.

Elements Identified and Measured

		(ug/L) or mg/kg (circle one)			(ug/L) or mg/kg (circle one)
1.	Aluminum	<200U	13.	Magnesium	<1000U
2.	Antimony	<20U	14.	Manganese	<10U
3.	Arsenic	<10U	15.	Mercury	<0.2U
4.	Barium	<200UJ	16.	Nickel	<40U
5.	Beryllium	<5U	17.	Potassium	<200U
6.	Cadmium	<2U J	18.	Selenium	<2U
7.	Calcium	<1000U	19.	Silver	<10U
8.	Chromium	<10U	20.	Sodium	2000
9.	Cobalt	<50U	21.	Thallium	<10U
10.	Copper	210	22.	Tin	<20U
11.	Iron	130 J	23.	Vanadium	<20U
12.	Lead	<5U	24.	Zinc	50 [b]

Cyanide N.A. Percent Solids N.A.

For reporting results to EPA, the following result qualifiers are used. Additional flags or footnotes explaining results are encouraged. Definition of such flags must be explicit, however.

Value If the result is a value greater than or equal to the detection limit, report the value.

U Indicates element was analyzed for but not detected. Report the detection limit value with the U (e.g., 10U).

J Indicates an estimated value or a value not reported due to the presence of interference. J must be accompanied by explanatory note in cover letter.

s Indicates value determined by Method of Standard Addition.

Comments: [b] Corrected for blank as lab. acids contain small amount of zinc

USEPA Contract Laboratory Program
Sample Management Office
P.O. Box 818 — Alexandria, Virginia 22313
703/557-2490 FTS 8-557-2490

Sample No.
NJ-71-GW-2

INORGANICS ANALYSIS DATA SHEET

LAB NAME NUS Corp/SCO CASE NO. NJ-71

LAB SAMPLE ID. NO. 24081645 QC REPORT NO. N.A.

Elements Identified and Measured

		ug/L or mg/kg (circle one)			ug/L or mg/kg (circle one)
1.	Aluminum	<200U	13.	Magnesium	1600
2.	Antimony	<20U	14.	Manganese	<10U [sm] <10U
3.	Arsenic	<10U	15.	Mercury	<0.2U
4.	Barium	<200UJ	16.	Nickel	<40U
5.	Beryllium	<5U	17.	Potassium	<2000U
6.	Cadmium	<2U J	18.	Selenium	<2U
7.	Calcium	<1000U	19.	Silver	<10U
8.	Chromium	<10U	20.	Sodium	8000
9.	Cobalt	<50U	21.	Thallium	<10 U
10.	Copper	190	22.	Tin	<20U
11.	Iron	110 J	23.	Vanadium	<20U
12.	Lead	<5U	24.	Zinc	220 [b]

Cyanide N.A. Percent Solids N.A.

For reporting results to EPA, the following result qualifiers are used. Additional flags or footnotes explaining results are encouraged. Definition of such flags must be explicit, however.

Value If the result is a value greater than or equal to the detection limit, report the value.

U Indicates element was analyzed for but not detected. Report the detection limit value with the U (e.g., 10U).

J Indicates an estimated value or a value not reported due to the presence of interference. J must be accompanied by explanatory note in cover letter.

s Indicates value determined by Method of Standard Addition.

Comments: [b] Corrected for blank as lab acids contained Zinc

USEPA Contract Laboratory Program
Sample Management Office
P.O. Box 818 — Alexandria, Virginia 22313
703/557-2490 FTS 8-557-2490

Sample No.
NJ-71-SW-1

INORGANICS ANALYSIS DATA SHEET

LAB NAME NUS/SCO CASE NO. NJ-71

LAB SAMPLE ID. NO. 24081646 QC REPORT NO. NA

Elements Identified and Measured

		(ug/L) or mg/kg (circle one)			(ug/L) or mg/kg (circle one)
1.	Aluminum	<200U	13.	Magnesium	2400
2.	Antimony	<20U	14.	Manganese	40
3.	Arsenic	<10U	15.	Mercury	<0.2U
4.	Barium	<200UJ	16.	Nickel	<40U
5.	Beryllium	<5U	17.	Potassium	2000
6.	Cadmium	<2UJ	18.	Selenium	<2U
7.	Calcium	8300	19.	Silver	<10U
8.	Chromium	<10U	20.	Sodium	5000
9.	Cobalt	<50U	21.	Thallium	<10U
10.	Copper	<20U	22.	Tin	<20U
11.	Iron	15,000	23.	Vanadium	<20U
12.	Lead	<5U	24.	Zinc	<20U[b]

Cyanide N.A. Percent Solids N.A.

For reporting results to EPA, the following result qualifiers are used. Additional flags or footnotes explaining results are encouraged. Definition of such flags must be explicit, however.

Value If the result is a value greater than or equal to the detection limit, report the value.

U Indicates element was analyzed for but not detected. Report the detection limit value with the U (e.g., 10U).

J Indicates an estimated value or a value not reported due to the presence of interference. J must be accompanied by explanatory note in cover letter.

s Indicates value determined by Method of Standard Addition.

Comments: [b] Corrected for blank as lab acids contained zinc.

USEPA Contract Laboratory Program
Sample Management Office
P.O. Box 818 — Alexandria, Virginia 22313
703/557-2490 FTS 8-557-2490

Sample No.
NJ-71-SW-2

INORGANICS ANALYSIS DATA SHEET

LAB NAME NVS Corp / SCO. CASE NO. NJ 71

LAB SAMPLE ID. NO. 24081647 QC REPORT NO. NA

Elements Identified and Measured

		ug/L or mg/kg (circle one)			ug/L or mg/kg (circle one)
1.	Aluminum	13,000	13.	Magnesium	8600
2.	Antimony	<200 [a]	14.	Manganese	260
3.	Arsenic	40	15.	Mercury	<0.2U
4.	Barium	400	16.	Nickel	<40U
5.	Beryllium	<5U	17.	Potassium	3000
6.	Cadmium	4 J	18.	Selenium	<2U
7.	Calcium	57000	19.	Silver	<10U
8.	Chromium	90	20.	Sodium	5000
9.	Cobalt	<50U	21.	Thallium	<10U
10.	Copper	60	22.	Tin	<20U
11.	Iron	1,000,000	23.	Vanadium	<200 [a]
12.	Lead	300	24.	Zinc	420 [b]

Cyanide N.A. Percent Solids N.A.

For reporting results to EPA, the following result qualifiers are used. Additional flags or footnotes explaining results are encouraged. Definition of such flags must be explicit, however.

Value If the result is a value greater than or equal to the detection limit, report the value.

U Indicates element was analyzed for but not detected. Report the detection limit value with the U (e.g., 10U).

J Indicates an estimated value or a value not reported due to the presence of interference. J must be accompanied by explanatory note in cover letter.

s Indicates value determined by Method of Standard Addition.

Comments: [b] Corrected for blank as lab acids contained zinc
[a] Detection limit higher due to matrix interferences

USEPA Contract Laboratory Program
Sample Management Office
P.O. Box 818 — Alexandria, Virginia 22313
703/557-2490 FTS 8-557-2490

Sample No.
NJ-71-WB-1

INORGANICS ANALYSIS DATA SHEET

LAB NAME N.V.S Corp / S.C.O. CASE NO. NJ 71

LAB SAMPLE ID. NO. 24081648 QC REPORT NO. NA

Elements Identified and Measured

		ug/L or mg/kg (circle one)			ug/L or mg/kg (circle one)
1.	Aluminum	<200 U	13.	Magnesium	<1000U
2.	Antimony	<20 U	14.	Manganese	<10U
3.	Arsenic	<10 U	15.	Mercury	<0.2U
4.	Barium	<200U J	16.	Nickel	<40U
5.	Beryllium	<5U	17.	Potassium	<2000U
6.	Cadmium	<2U J	18.	Selenium	<2U
7.	Calcium	<1000U	19.	Silver	<10U
8.	Chromium	<10U	20.	Sodium	<1000U
9.	Cobalt	<50U	21.	Thallium	<10U
10.	Copper	<20U	22.	Tin	<20U
11.	Iron	<100U J	23.	Vanadium	<20U
12.	Lead	<5U	24.	Zinc	<20U [b]

Cyanide N.A. Percent Solids N.A

For reporting results to EPA, the following result qualifiers are used. Additional flags or footnotes explaining results are encouraged. Definition of such flags must be explicit, however.

Value If the result is a value greater than or equal to the detection limit, report the value.

U Indicates element was analyzed for but not detected. Report the detection limit value with the U (e.g., 10U).

J Indicates an estimated value or a value not reported due to the presence of interference. J must be accompanied by explanatory note in cover letter.

s Indicates value determined by Method of Standard Addition.

Comments: [b] Corrected for blank value as lab acids contained Zinc.

USEPA Contract Laboratory Program
Sample Management Office
P.O. Box 818 — Alexandria, Virginia 22313
703/557-2490 FTS 8-557-2490

Sample No.
NJ-71-Soil-1

INORGANICS ANALYSIS DATA SHEET

LAB NAME NUS/SCO CASE NO. NJ71

LAB SAMPLE ID. NO. 24081650 QC REPORT NO. N.A.

Elements Identified and Measured

		ug/L or (mg/kg) (circle one)			ug/L or (mg/kg) (circle one)
1.	Aluminum	2100	13.	Magnesium	130
2.	Antimony	<3U	14.	Manganese	140
3.	Arsenic	1.5	15.	Mercury	<0.3U
4.	Barium	<30UJ	16.	Nickel	<6U
5.	Beryllium	<0.7U	17.	Potassium	<290U
6.	Cadmium	<0.3 ~~<0.7U~~ J	18.	Selenium	<0.3U
7.	Calcium	550	19.	Silver	<1.5U
8.	Chromium	9	20.	Sodium	140
9.	Cobalt	<7 U	21.	Thallium	<1.5U
10.	Copper	4	22.	Tin	10
11.	Iron	46,000	23.	Vanadium	12
12.	Lead	22	24.	Zinc	58

Cyanide N.A. Percent Solids 34.4

For reporting results to EPA, the following result qualifiers are used. Additional flags or footnotes explaining results are encouraged. Definition of such flags must be explicit, however.

Value If the result is a value greater than or equal to the detection limit, report the value.

U Indicates element was analyzed for but not detected. Report the detection limit value with the U (e.g., 10U).

J Indicates an estimated value or a value not reported due to the presence of interference. J must be accompanied by explanatory note in cover letter.

s Indicates value determined by Method of Standard Addition.

Comments:

USEPA Contract Laboratory Program
Sample Management Office
P.O. Box 818 — Alexandria, Virginia 22313
703/557-2490 FTS 8-557-2490

Sample No.
NJ-71-Soil-2

INORGANICS ANALYSIS DATA SHEET

LAB NAME NUS/SCO CASE NO. NJ-71

LAB SAMPLE ID. NO. 24081651 QC REPORT NO. N.A.

Elements Identified and Measured

		ug/L or (mg/kg) (circle one)			ug/L or (mg/kg) (circle one)
1.	Aluminum	2100	13.	Magnesium	150
2.	Antimony	<31U	14.	Manganese	150
3.	Arsenic	1.4	15.	Mercury	0.5
4.	Barium	<27U J	16.	Nickel	11
5.	Beryllium	<0.7U	17.	Potassium	<270U
6.	Cadmium	<0.3U J	18.	Selenium	<0.3U
7.	Calcium	600	19.	Silver	<1.5U
8.	Chromium	10	20.	Sodium	270
9.	Cobalt	<7 U	21.	Thallium	<1.4U
10.	Copper	<3U	22.	Tin	7
11.	Iron	38,000	23.	Vanadium	16
12.	Lead	27	24.	Zinc	71

Cyanide N.A Percent Solids 36.6

For reporting results to EPA, the following result qualifiers are used. Additional flags or footnotes explaining results are encouraged. Definition of such flags must be explicit, however.

Value If the result is a value greater than or equal to the detection limit, report the value.

U Indicates element was analyzed for but not detected. Report the detection limit value with the U (e.g., 10U).

J Indicates an estimated value or a value not reported due to the presence of interference. J must be accompanied by explanatory note in cover letter.

s Indicates value determined by Method of Standard Addition.

Comments:

USEPA Contract Laboratory Program
Sample Management Office
P.O. Box 818 — Alexandria, Virginia 22313
703/557-2490 FTS 8-557-2490

Sample No.
NJ-71-SED-1

INORGANICS ANALYSIS DATA SHEET

LAB NAME NUS/SCO CASE NO. NJ-71

LAB SAMPLE ID. NO. 24081652 QC REPORT NO. N.A.

Elements Identified and Measured

		ug/L or (mg/kg) (circle one)			ug/L or (mg/kg) (circle one)
1.	Aluminum	160	13.	Magnesium	<50U
2.	Antimony	<1U	14.	Manganese	4.6
3.	Arsenic	<0.6U	15.	Mercury	<0.1U
4.	Barium	<13U	16.	Nickel	<3U
5.	Beryllium	<0.3U	17.	Potassium	<130U
6.	Cadmium	<0.1U	18.	Selenium	<0.1U
7.	Calcium	120	19.	Silver	<0.6U
8.	Chromium	3	20.	Sodium	<66U
9.	Cobalt	<3U	21.	Thallium	<0.6U
10.	Copper	<1U	22.	Tin	3
11.	Iron	17,000	23.	Vanadium	4
12.	Lead	2.6	24.	Zinc	17

Cyanide N.A. Percent Solids 75.9

For reporting results to EPA, the following result qualifiers are used. Additional flags or footnotes explaining results are encouraged. Definition of such flags must be explicit, however.

Value If the result is a value greater than or equal to the detection limit, report the value.

U Indicates element was analyzed for but not detected. Report the detection limit value with the U (e.g., 10U).

J Indicates an estimated value or a value not reported due to the presence of interference. J must be accompanied by explanatory note in cover letter.

s Indicates value determined by Method of Standard Addition.

Comments:

USEPA Contract Laboratory Program
Sample Management Office
P.O. Box 818 — Alexandria, Virginia 22313
703/557-2490 FTS 8-557-2490

Sample No.
NJ-71-SED-2

INORGANICS ANALYSIS DATA SHEET

LAB NAME NUS/SCO CASE NO. NJ-71-SED-2

LAB SAMPLE ID. NO. 24081653 QC REPORT NO. _____

Elements Identified and Measured

		ug/L or (mg/kg) (circle one)			ug/L or (mg/kg) (circle one)
1.	Aluminum	1100	13.	Magnesium	68
2.	Antimony	<2U	14.	Manganese	18
3.	Arsenic	0.9	15.	Mercury	<0.2U
4.	Barium	<18U	16.	Nickel	<4U
5.	Beryllium	<0.4U	17.	Potassium	<180U
6.	Cadmium	<0.2U	18.	Selenium	<0.2U
7.	Calcium	190	19.	Silver	<0.9U
8.	Chromium	4	20.	Sodium	<91U
9.	Cobalt	<4.5U	21.	Thallium	<0.9U
10.	Copper	3	22.	Tin	4
11.	Iron	11,000	23.	Vanadium	7
12.	Lead	9.1	24.	Zinc	26

Cyanide N.A. Percent Solids 54.6

For reporting results to EPA, the following result qualifiers are used. Additional flags or footnotes explaining results are encouraged. Definition of such flags must be explicit, however.

Value If the result is a value greater than or equal to the detection limit, report the value.

U Indicates element was analyzed for but not detected. Report the detection limit value with the U (e.g., 10U).

J Indicates an estimated value or a value not reported due to the presence of interference. J must be accompanied by explanatory note in cover letter.

s Indicates value determined by Method of Standard Addition.

Comments: _____

USEPA Contract Laboratory Program
Sample Management Office
P.O. Box 818 — Alexandria, Virginia 22313
703/557-2490 FTS 8-557-2490

Sample No.
NJ-71-SB-1

INORGANICS ANALYSIS DATA SHEET

LAB NAME N.V.S/SCO CASE NO. NJ-71

LAB SAMPLE ID. NO. 24081654 QC REPORT NO. N.A.

Elements Identified and Measured

		ug/L or (mg/kg) (circle one)			ug/L or (mg/kg) (circle one)
1.	Aluminum	<10U	13.	Magnesium	<50U
2.	Antimony	<1U	14.	Manganese	<0.5U
3.	Arsenic	<0.5U	15.	Mercury	<0.1U
4.	Barium	<10U J	16.	Nickel	<2U
5.	Beryllium	<0.25U	17.	Potassium	<100U
6.	Cadmium	<0.1U J	18.	Selenium	<0.1U
7.	Calcium	<50U	19.	Silver	<0.5U
8.	Chromium	<0.5U	20.	Sodium	<50U
9.	Cobalt	<2.5U	21.	Thallium	<0.5U
10.	Copper	<1U	22.	Tin	<1U
11.	Iron	<5U	23.	Vanadium	<1U
12.	Lead	0.3	24.	Zinc	<0.5U

Cyanide N.A. Percent Solids N.A.

For reporting results to EPA, the following result qualifiers are used. Additional flags or footnotes explaining results are encouraged. Definition of such flags must be explicit, however.

Value If the result is a value greater than or equal to the detection limit, report the value.

U Indicates element was analyzed for but not detected. Report the detection limit value with the U (e.g., 10U).

J Indicates an estimated value or a value not reported due to the presence of interference. J must be accompanied by explanatory note in cover letter.

s Indicates value determined by Method of Standard Addition.

Comments:

REFERENCE #17

TABLE 1

Sample Descriptions
Lakewood Township Landfill
Lakewood, New Jersey
NUS Case #NJ71

Sample Number	Sample Type	Federal Express Airbill Number	Time	Location
SW-1	Organic Aqueous Inorganic Aqueous	718394810 718394821	1345	Cedar Creek on West side of site.
SED-1	Organic Sediment Inorganic Sediment	718394810 718394821	1350	Same location as SW-1.
SOIL-1	Organic Soil Inorganic Soil	718394810 718394821	1410	Discolored soil along dried up section of East side of Cedar Creek.
SOIL-2	Organic Soil Inorganic Soil	718394810 718394821	1415	Same locaton as SOIL-1.
SW-2	Organic Aqueous Inorganic Aqueous	718394810 718394821	1430	Cedar Creek near sand piles.
SED-2	Organic Sediment Inorganic Sediment	718394810 718394821	1435	Same location as SW-2.
GW-2	Organic Aqueous Inorganic Aqueous	718394810 718394821	1500	Well on site near New Hampshire Ave.
GW-1	Organic Aqueous Inorganic Aqueous	718394810 718394821	1600	Private residence near site on E. Spruce Street
WB-1	Organic Aqueous[a] Inorganic Aqueous	718394810 718394821	N/A[b]	Aqueous blank.
SB-1	Organic Soil[c] Inorganic Soil	718394810 718394821	N/A[b]	Soil blank.

NOTES:

(a) Organic and inorganic aqueous blanks contained doubly deionized distilled water taken from EPA, Edison, N.J. on 8/29/84.

(b) N/A = Not Applicable.

(c) Organic and inorganic soil/sediment blanks contained doubly deionized distilled wate taken from EPA, Edison, N.J. on 8/29/84.

ORGANIC DATA REPORTING QUALIFIERS

For reporting results to EPA, the following results qualifiers are used. Additional flags or footnotes explaining results are encouraged. However, the definition of such flags must be explicit.

Value -If the result is a value greater than or equal to the detection limit, report the value.

U -Indicates compound was analyzed for but not detected. Report the minimum detection limit for the sample with the U (e.g., 10U) based on necessary concentration/dilution actions. (This is not necessarily the instrument detection limit.) The footnote should read: U-Compound was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

J -Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero. (e.g., 10J)

C -This flag applies to pesticide parameters where the identification has been confirmed by GC/MS. Single component pesticides $\geq$10 ng/ul in the final extract should be confirmed by GC/MS.

B -This flag is used when the analyte is found in the blank as well as a sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

Other -Other specific flags and footnotes may be required to properly define the results. If used, they must be fully described and such description attached to the data summary report.

Environmental Protection Agency
CLP Sample Management Office
P.O.Box 818
Alexandria, Virginia 22313 703/557-2490

LAKEWOOD Township LF

Sample Number
NJ-71-SOIL-1

Organics Analysis Data Sheet
(Page 1)

Laboratory Name: NUS CORPORATION
Lab Sample ID No: 14082174 MLS
Sample Matrix: Soil
Data Release Authorized By:

Case No: NJ-71
QC Report No:
Contract No:
Date Sample Received: 8/30/84

****

Volatile Compounds

Concentration: Medium
Date Extracted/Prepared: 9/5/84
Date Analyzed: 9/5/84
Conc/Dil Factor: 1 pH 6
Percent Moisture: 32
Percent Moisture (Decanted): NR

CAS Number		ug/kg
74-87-3	Chloromethane	1500 u
74-83-9	Bromomethane	1500 u
75-01-4	Vinyl chloride	1500 u
75-00-3	Chloroethane	1500 u
75-09-2	Methylene Chloride	6700 B
67-64-1	Acetone	210000 B
75-15-0	Carbon Disulfide	820
75-35-4	1,1-Dichloroethene	750 u
75-34-3	1,1-Dichloroethane	750 u
156-60-5	Trans-1,2-Dichloroethene	750 u
67-66-3	Chloroform	750 u
107-06-2	1,2-Dichloroethane	750 u
78-93-3	2-Butanone	3900 B
71-55-6	1,1,1-Trichloroethane	750 u
56-23-5	Carbon Tetrachloride	750 u
108-05-4	Vinyl Acetate	1500 u
75-27-4	Bromodichloromethane	750 u

Data reporting qualifiers are explained on Page 2.
****

Sample Number
NJ-71-SOIL-1

Organics Analysis Data Sheet
(Page 2)

Volatile Compounds (continued)

Case Number		ug/kg
		**********
79-34-5	1,1,2,2-Tetrachloroethane	750 u
78-87-5	1,2-Dichloropropane	750 u
10061-02-6	Trans-1,3-Dichloropropene	750 u
79-01-6	Trichloroethene	750 u
124-48-1	Dibromochloromethane	750 u
79-00-5	1,1,2-Trichloroethane	750 u
71-43-2	Benzene	750 u
10061-01-5	cis-1,3-Dichloropropene	750 u
110-75-8	2-Chloroethylvinylether	1500 u
75-25-2	Bromoform	750 u
591-78-6	2-Hexanone	1500 u
108-10-1	4-Methyl-2-Pentanone	1500 u
127-18-4	Tetrachlorethene	750 u
108-88-3	Toluene	750 u
108-90-7	Chlorobenzene	750 u
100-41-4	Ethylbenzene	750 u
100-42-5	Styrene	750 u
	Total Xylenes	750 u
107-02-8	Acrolein	15000 u
107-13-1	Acrylonitrile	15000 u

Data Reporting Qualifiers

For reporting results to EPA, the following results qualifiers are used. Additional flags or footnotes explaining results are encouraged. However, the definition of each flag must be explained.

Value - If the result is a value greater than or equal to the detection limit, report the value

U - Indicates compound was analyzed for but not detected. Report the minimum detection limit for the sample with the U (e.g. 10U) based on necessary concentration/dilution actions. (This is not necessarily the instrument detection limit.) The footnote should read U - Compound was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

J - Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the indicated detection limit but greater than zero (e.g. 10J).

C - This flag applies to pesticide parameters where the identification has been comfirmed by GC/MS. Single component pesticides)=10ng/ul in the final extract should be confirmed by GC/MS.

B - This flag is used when the analyte is found in the blank as well as a sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

S - Spiked compound.

NR - No value required.

SAMPLE NUMBER
NJ-71-SOIL-1

Organics Analysis Data Sheet
(Page 3)

Semivolatile Compounds

Concentration: Low
Date Extracted/Prepared: 9/10/84
Date Analyzed: 9/24/84
Conc/Dil Factor: 10(DIL)

CAS Number		ug/kg
		**********
62-75-9	N-Nitrosodimethylamine	4950 u
108-95-2	Phenol	4950 u
62-53-3	Aniline	4950 u
111-44-4	bis(2-Chloroethyl)Ether	4950 u
95-57-8	2-Chlorophenol	4950 u
541-73-1	1,3-Dichlorobenzene	4950 u
106-46-7	1,4-Dichlorobenzene	4950 u
100-51-6	Benzyl Alcohol	4950 u
95-50-1	1,2-Dichlorobenzene	4950 u
95-48-7	2-Methylphenol	4950 u
39638-32-9	bis(2-chloroisopropyl)Ether	4950 u
106-44-5	4-Methylphenol	4950 u
621-64-7	N-Nitroso-Di-n-Propylamine	4950 u
67-72-1	Hexachloroethane	4950 u
98-95-3	Nitrobenzene	4950 u
78-59-1	Isophorone	4950 u
88-75-5	2-Nitrophenol	4950 u
105-67-9	2,4-Dimethylphenol	4950 u
65-85-0	Benzoic Acid	24000 u
111-91-1	bis(2-Chloroethoxy)Methane	4950 u
120-83-2	2,4-Dichlorophenol	4950 u
120-82-1	1,2,4-Trichlorobenzene	4950 u
91-20-3	Naphthalene	4950 u
106-47-8	4-Chloroaniline	4950 u
87-68-3	Hexachlorobutadiene	4950 u
59-50-7	4-Chloro-3-Methylphenol	4950 u
91-57-6	2-Methylnaphthalene	4950 u
77-47-4	Hexachlorocyclopentadiene	4950 u
88-06-2	2,4,6-Trichlorophenol	4950 u
95-95-4	2,4,5-Trichlorophenol	24000 u
91-58-7	2-Chloronaphthalene	4950 u
88-74-4	2-Nitroaniline	4950 u
131-11-3	Dimethyl Phthalate	4950 u
208-96-8	Acenaphthylene	4950 u
99-09-2	3-Nitroaniline	24000 u

Sample Number
NJ-71-SOIL-1

Organics Analysis Data Sheet
(Page 4)

Semivolatile Compounds (continued)

Case Number		ug/kg
		**********
83-32-9	Acenaphthene	4950 u
51-28-5	2,4-Dinitrophenol	24000 u
100-02-7	4-Nitrophenol	24000 u
132-64-9	Dibenzofuran	4950 u
121-14-2	2,4-Dinitrotoluene	4950 u
606-20-2	2,6-Dinitrotoluene	4950 u
84-66-2	Diethylphthalate	4950 u
7005-72-3	4-Chlorophenyl-phenylether	4950 u
86-73-7	Fluorene	4950 u
100-01-6	4-Nitroaniline	24000 u
534-52-1	4,6-Dinitro-2-Methylphenol	24000 u
86-30-6	N-Nitrosodiphenylamine(1)	4950 u
101-55-3	4-Bromophenyl-phenylether	4950 u
118-74-1	Hexachlorobenzene	4950 u
87-86-5	Pentachlorophenol	24000 u
85-01-8	Phenanthrene	4950 u
120-12-7	Anthracene	4950 u
84-74-2	Di-n-Butylphthalate	9000 B ✓
206-44-0	Fluoranthene	4950 u
92-87-5	Benzidine	24000 u
129-00-0	Pyrene	4950 u
85-68-7	Butylbenzylphthalate	4950 u
91-94-1	3,3 -Dichlorobenzidine	9900 u
56-55-3	Benzo(a)Anthracene	4950 u
117-81-7	bis(2-Ethylhexyl)Phthalate	32000 ✓
218-01-9	Chrysene	4950 u
117-84-0	Di-n-Octyl Phthalate	28000 ✓
205-99-2	Benzo(b)Fluoranthene	4950 u
207-08-9	Benzo(k)Fluoranthene	4950 u
50-32-8	Benzo(a)Pyrene	4950 u
193-39-5	Indeno(1,2,3-cd)Pyrene	4950 u
53-70-3	Dibenzo(a,h)Anthracene	4950 u
191-24-2	Benzo(g,h,i)Perylene	4950 u
122-66-7	1,2-Diphenylhydrazine	9900 u

(1)-Cannot be separated from diphenylamine

SAMPLE NUMBER
NJ-71-SOIL-1

Organics Analysis Data Sheet
(Page 5)

Pesticide/PCBs

Concentration: Low
Date Extracted/Prepared: 9/10/84
Date Analyzed: 9/25/84
Conc/Dil Factor: 200,DIL

CAS Number		ug/kg
		**********
319-84-6	Alpha-BHC	600.0 U
319-85-7	Beta-BHC	600.0 U
319-86-8	Delta-BHC	600.0 U
58-89-9	Gamma-BHC(lindane)	600.0 U
76-44-8	Heptachlor	600.0 U
309-00-2	Aldrin	600.0 U
1024-57-3	Heptachlor Epoxide	600.0 U
959-98-8	Endosulfan I	600.0 U
60-57-1	Dieldrin	1200.0 U
72-55-9	4,4'-DDE	1200.0 U
72-20-8	Endrin	1200.0 U
33213-65-9	Endosulfan II	1200.0 U
72-54-8	4,4'-DDD	1200.0 U
7421-93-4	Endrin Aldehyde	1200.0 U
1031-07-8	Endosulfan Sulfate	1200.0 U
50-29-3	4,4'-DDT	1200.0 U
72-43-5	Methoxychlor	6000.0 U
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin	600.0 U
57-74-9	Chlordane	6000.0 U
8001-35-2	Toxaphene	12000.0 U
12674-11-2	Aroclor-1016	6000.0 U
11104-28-2	Aroclor-1221	6000.0 U
11141-16-5	Aroclor-1232	6000.0 U
53469-21-9	Aroclor-1242	6000.0 U
12672-29-6	Aroclor-1248	6000.0 U
11097-69-1	Aroclor-1254	12000.0 U
11096-82-5	Aroclor-1260	12000.0 U

Vi = Volume of extract injected (ul)
Vs = Volume of water extracted (ml)
Ws = Weight of sample extracted (g)
Vt = Volume of total extract (ul)

Vs or Ws 20 Vt 5000 Vi 2

Sample Number
NJ-71-SOIL-1

Organics Analysis Data Sheet
(Page 6)

Tentatively Identified Compounds

Cas Number		Fraction	Scan	Estimated Concentration ug/kg
	NO VOA COMPOUND FOUND			

Sample Number
NJ-7Y-SOIL-1

Organics Analysis Data Sheet
(Page 6)

Tentatively Identified Compounds

Cas Number		Fraction	Scan	Estimated Concentration ug/kg	
20959-33-5	HEPTADECANE,7-METHYL-	BNA	967	2000	
10544-50-0	SULFUR (S8)	BNA	1204	3000	
	UNKNOWN	BNA	1432	2000	
84-61-7	1,2-BENZENEDICARBOXYLICACID,DICYCLOHEXYLESTER	BNA	1466	4000	
	UNKNOWN (PHTHALATE)	BNA	1530	8000	
	UNKNOWN (PHTHALATE)	BNA	1498	2000	
	UNKNOWN (PHTHALATE)	BNA	1517	2000	
	UNKNOWN (PHTHALATE)	BNA	1535	6000	
	UNKNOWN (PHTHALATE)	BNA	1620	2000	
	UNKNOWN (PHTHALATE)	BNA	1627	1000	
	UNKNOWN (PHTHALATE)	BNA	1659	6000	
	UNKNOWN (PHTHALATE)	BNA	1720	2000	
	UNKNOWN (PHTHALATE)	BNA	1761	3000	
	UNKNOWN (PHTHALATE)	BNA	1848	7000	
	UNKNOWN (HYDROCARBON)	BNA	1874	3000	
	UNKNOWN (PHTHALATE)	BNA	1920	1000	
123-42-2	4-METHYL-4-HYDROXY-2-PENTANONE,ALDOL PRODUCT	BNA	229	8000	

[illegible] Protection Agency
[illegible] Sample Management Office
P.O. Box 818
Alexandria, Virginia 22313 703/557-2490

Sample Number
NJ-71-SOIL-2

Organics Analysis Data Sheet
(Page 1)

Laboratory Name: NUS CORPORATION
Lab Sample ID No: 14082175
Sample Matrix: Soil
Data Release Authorized By:

Case No: NJ-71
QC Report No:
Contract No:
Date Sample Received: 8/30/84

****

Volatile Compounds

Concentration: Medium
Date Extracted/Prepared: 9/5/84
Date Analyzed: 9/5/84
Conc/Dil Factor: 2 pH 6
Percent Moisture: 39
Percent Moisture (Decanted): NR

CAS Number		ug/kg	
74-87-3	Chloromethane		3200 u
74-83-9	Bromomethane		3200 u
75-01-4	Vinyl chloride		3200 u
75-00-3	Chloroethane		3200 u
75-09-2	Methylene Chloride	8900 B	✓
67-64-1	Acetone	100000 B	✓
75-15-0	Carbon Disulfide		1600 u
75-35-4	1,1-Dichloroethene		1600 u
75-34-3	1,1-Dichloroethane		1600 u
156-60-5	Trans-1,2-Dichloroethene		1600 u
67-66-3	Chloroform		1600 u
107-06-2	1,2-Dichloroethane		1600 u
78-93-3	2-Butanone	~~4000~~ B	✓
71-55-6	1,1,1-Trichloroethane		1600 u
56-23-5	Carbon Tetrachloride		1600 u
108-05-4	Vinyl Acetate		3200 u
75-27-4	Bromodichloromethane		1600 u

Data reporting qualifiers are explained on Page 2.
****

Sample Number
NJ-71-SOIL-2

Organics Analysis Data Sheet
(Page 2)

Volatile Compounds (continued)

Case Number		ug/kg **********	
79-34-5	1,1,2,2-Tetrachloroethane	1600	u
78-87-5	1,2-Dichloropropane	1600	u
10061-02-6	Trans-1,3-Dichloropropene	1600	u
79-01-6	Trichloroe[illegible]ene	1600	u
124-48-1	Dibromochl[illegible]omethane	1600	u
79-00-5	1,1,2-Trichloroethane	1600	u
71-43-2	Benzene	1600	u
10061-01-5	cis-1,3-Dichloropropene	1600	u
110-75-8	2-Chloroethylvinylether	3200	u
75-25-2	Bromoform	1600	u
591-78-6	2-Hexanone	3200	u
108-10-1	4-Methyl-2-Pentanone	3200	u
127-18-4	Tetrachlorethene	1600	u
108-88-3	Toluene	1600	u
108-90-7	Chlorobenzene	1600	u
100-41-4	Ethylbenzene	1600	u
100-42-5	Styrene	1600	u
	Total Xylenes	1600	u
107-02-8	Acrolein	32000	u
107-13-1	Acrylonitrile	32000	u

Data Reporting Qualifiers

For reporting results to EPA, the following results qualifiers are used. Additional flags or footnotes explaining results are encouraged. However, the definition of each flag must be explained.

Value - If the result is a value greater than or equal to the detection limit, report the value

U - Indicates compound was analyzed for but not detected. Report the minimum detection limit for the sample with the U (e.g. 10U) based on necessary concentration/dilution actions. (This is not necessarily the instrument detection limit.) The footnote should read U - Compound was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

J - Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicates the pr[illegible]ence of a compound that meets the identification criteria but the result is less than the indicated detection limit but greater than zero (e.g. 10J).

C - This flag applies to pesticide parameters where the identification has been comfirmed by GC/MS. Single component pesticides)=10ng/ul in the final extract should be confirmed by GC/MS.

B - This flag is used when the analyte is found in the blank as well as a sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

S - Spiked compound.

NR - No value required.

SAMPLE NUMBER
NJ-71-SED-1

Organics Analysis Data Sheet
(Page 3)

Semivolatile Compounds

Concentration: Low
Date Extracted/Prepared: 9/10/84
Date Analyzed: 9/24/84
Conc/Dil Factor: 1

CAS Number		ug/kg
		**********
62-75-9	N-Nitrosodimethylamine	462 U
108-95-2	Phenol	462 U
62-53-3	Aniline	462 U
111-44-4	bis(2-Chloroethyl)Ether	462 U
95-57-8	2-Chlorophenol	462 U
541-73-1	1,3-Dichlorobenzene	462 U
106-46-7	1,4-Dichlorobenzene	462 U
100-51-6	Benzyl Alcohol	462 U
95-50-1	1,2-Dichlorobenzene	462 U
95-48-7	2-Methylphenol	462 U
39638-32-9	bis(2-chloroisopropyl)Ether	462 U
106-44-5	4-Methylphenol	462 U
621-64-7	N-Nitroso-Di-n-Propylamine	462 U
67-72-1	Hexachloroethane	462 U
98-95-3	Nitrobenzene	462 U
78-59-1	Isophorone	462 U
88-75-5	2-Nitrophenol	462 U
105-67-9	2,4-Dimethylphenol	462 U
65-85-0	Benzoic Acid	2240 U
111-91-1	bis(2-Chloroethoxy)Methane	462 U
120-83-2	2,4-Dichlorophenol	462 U
120-82-1	1,2,4-Trichlorobenzene	462 U
91-20-3	Naphthalene	462 U
106-47-8	4-Chloroaniline	462 U
87-68-3	Hexachlorobutadiene	462 U
59-50-7	4-Chloro-3-Methylphenol	462 U
91-57-6	2-Methylnaphthalene	462 U
77-47-4	Hexachlorocyclopentadiene	462 U
88-06-2	2,4,6-Trichlorophenol	462 U
95-95-4	2,4,5-Trichlorophenol	2240 U
91-58-7	2-Chloronaphthalene	462 U
88-74-4	2-Nitroaniline	462 U
131-11-3	Dimethyl Phthalate	462 U
208-96-8	Acenaphthylene	462 U
99-09-2	3-Nitroaniline	2240 U

Sample Number
NJ-71-SED-1

Organics Analysis Data Sheet
(Page 4)

Semivolatile Compounds (continued)

Case Number		ug/kg
		**********
83-32-9	Acenaphthene	~~462 U~~
51-28-5	2,4-Dinitrophenol	~~2240 U~~
100-02-7	4-Nitrophenol	~~2240 U~~
132-64-9	Dibenzofuran	~~462 U~~
121-14-2	2,4-Dinitrotoluene	~~462 U~~
606-20-2	2,6-Dinitrotoluene	~~462 U~~
84-66-2	Diethylphthalate	~~462 U~~
7005-72-3	4-Chlorophenyl-phenylether	~~462 U~~
86-73-7	Fluorene	~~462 U~~
100-01-6	4-Nitroaniline	~~2240 U~~
534-52-1	4,6-Dinitro-2-Methylphenol	~~2240 U~~
86-30-6	N-Nitrosodiphenylamine(1)	~~462 U~~
101-55-3	4-Bromophenyl-phenylether	~~462 U~~
118-74-1	Hexachlorobenzene	~~462 U~~
87-86-5	Pentachlorophenol	~~2240 U~~
85-01-8	Phenanthrene	~~462 U~~
120-12-7	Anthracene	~~462 U~~ ✓
84-74-2	Di-n-Butylphthalate	~~3100 B~~
206-44-0	Fluoranthene	~~462 U~~
92-87-5	Benzidine	~~2240 U~~
129-00-0	Pyrene	~~462 U~~
85-68-7	Butylbenzylphthalate	~~462 U~~ ✓
91-94-1	3,3 -Dichlorobenzidine	~~924 U~~
56-55-3	Benzo(a)Anthracene	~~462 U~~
117-81-7	bis(2-Ethylhexyl)Phthalate	~~3300~~
218-01-9	Chrysene	~~462 U~~ ✓
117-84-0	Di-n-Octyl Phthalate	520
205-99-2	Benzo(b)Fluoranthene	~~462 U~~
207-08-9	Benzo(k)Fluoranthene	462 U
50-32-8	Benzo(a)Pyrene	~~462 U~~
193-39-5	Indeno(1,2,3-cd)Pyrene	462 U
53-70-3	Dibenzo(a,h)Anthracene	~~462 U~~
191-24-2	Benzo(g,h,i)Perylene	462 U
122-66-7	1,2-Diphenylhydrazine	924 U

(1)-Cannot be separated from diphenylamine

SAMPLE NUMBER
NJ-71-SED-1

Organics Analysis Data Sheet
(Page 5)

Pesticide/PCBs

Concentration: Low
Date Extracted/Prepared: 9/10/84
Date Analyzed: 9/25/84
Conc/Dil Factor: 5 (DIL)

CAS Number		ug/kg **********
319-84-6	Alpha-BHC	14.0 U
319-85-7	Beta-BHC	14.0 U
319-86-8	Delta-BHC	14.0 U
58-89-9	Gamma-BHC(lindane)	14.0 U
76-44-8	Heptachlor	14.0 U
309-00-2	Aldrin	14.0 U
1024-57-3	Heptachlor Epoxide	14.0 U
959-98-8	Endosulfan I	14.0 U
60-57-1	Dieldrin	28.0 U
72-55-9	4,4'-DDE	28.0 U
72-20-8	Endrin	28.0 U
33213-65-9	Endosulfan II	28.0 U
72-54-8	4,4'-DDD	28.0 U
7421-93-4	Endrin Aldehyde	28.0 U
1031-07-8	Endosulfan Sulfate	28.0 U
50-29-3	4,4'-DDT	28.0 U
72-43-5	Methoxychlor	140.0 U
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin	14.0 U
57-74-9	Chlordane	140.0 U
8001-35-2	Toxaphene	280.0 U
12674-11-2	Aroclor-1016	140.0 U
11104-28-2	Aroclor-1221	140.0 U
11141-16-5	Aroclor-1232	140.0 U
53469-21-9	Aroclor-1242	140.0 U
12672-29-6	Aroclor-1248	140.0 U
11097-69-1	Aroclor-1254	280.0 U
11096-82-5	Aroclor-1260	280.0 U

Vi = Volume of extract injected (ul)
Vs = Volume of water extracted (ml)
Ws = Weight of sample extracted (g)
Vt = Volume of total extract (ul)

Vs or Ws 22 Vt 5000 Vi 2

Environmental Protection Agency
CLP Sample Management Office
P.O.Box 818
Alexandria, Virginia 22313 703/557-2490

Sample Number
NJ-71-SED-2

Organics Analysis Data Sheet
(Page 1)

Laboratory Name: NUS CORPORATION
Lab Sample ID No: 14082177 MLS
Sample Matrix: Soil
Data Release Authorized By:

Case No: NJ-71
QC Report No:
Contract No:
Date Sample Received: 8/30/84

****

Volatile Compounds

Concentration: Medium
Date Extracted/Prepared: 9/5/84
Date Analyzed: 9/5/84
Conc/Dil Factor: 1 pH 6
Percent Moisture: 37
Percent Moisture (Decanted): NR

CAS Number		ug/kg
74-87-3	Chloromethane	1600 u
74-83-9	Bromomethane	1600 u
75-01-4	Vinyl chloride	1600 u
75-00-3	Chloroethane	1600 u
75-09-2	Methylene Chloride	4500 B
67-64-1	Acetone	46000 B
75-15-0	Carbon Disulfide	6900
75-35-4	1,1-Dichloroethene	800 u
75-34-3	1,1-Dichloroethane	800 u
156-60-5	Trans-1,2-Dichloroethene	800 u
67-66-3	Chloroform	800 u
107-06-2	1,2-Dichloroethane	800 u
78-93-3	2-Butanone	4500 B
71-55-6	1,1,1-Trichloroethane	800 u
56-23-5	Carbon Tetrachloride	800 u
108-05-4	Vinyl Acetate	1600 u
75-27-4	Bromodichloromethane	800 u

Data reporting qualifiers are explained on Page 2.
****

Sample Number
NJ-71-SED-2

Organics Analysis Data Sheet
(Page 2)

Volatile Compounds (continued)

Case Number		ug/kg **********	
79-34-5	1,1,2,2-Tetrachloroethane	800	u
78-87-5	1,2-Dichloropropane	800	u
10061-02-6	Trans-1,3-Dichloropropene	800	u
79-01-6	Trichloroethene	800	u
124-48-1	Dibromochloromethane	800	u
79-00-5	1,1,2-Trichloroethane	800	u
71-43-2	Benzene	800	u
10061-01-5	cis-1,3-Dichloropropene	800	u
110-75-8	2-Chloroethylvinylether	1600	u
75-25-2	Bromoform	800	u
591-78-6	2-Hexanone	1600	u
108-10-1	4-Methyl-2-Pentanone	1600	u
127-18-4	Tetrachlorethene	800	u
108-88-3	Toluene	800	u
108-90-7	Chlorobenzene	800	u
100-41-4	Ethylbenzene	800	u
100-42-5	Styrene	800	u
	Total Xylenes	800	u
107-02-8	Acrolein	16000	u
107-13-1	Acrylonitrile	16000	u

Data Reporting Qualifiers

For reporting results to EPA, the following results qualifiers are used. Additional flags or footnotes explaining results are encouraged. However, the definition of each flag must be explained.

Value - If the result is a value greater than or equal to the detection limit, report the value

U - Indicates compound was analyzed for but not detected. Report the minimum detection limit for the sample with the U (e.g. 10U) based on necessary concentration/dilution actions. (This is not necessarily the instrument detection limit.) The footnote should read U - Compound was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

J - Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the indicated detection limit but greater than zero (e.g. 10J).

C - This flag applies to pesticide parameters where the identification has been comfirmed by GC/MS. Single component pesticides)=10ng/ul in the final extract should be confirmed by GC/MS.

B - This flag is used when the analyte is found in the blank as well as a sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

S - Spiked compound.

NR - No value required.

SAMPLE NUMBER
NJ-71-SED-2

Organics Analysis Data Sheet
(Page 3)

Semivolatile Compounds

Concentration: Low
Date Extracted/Prepared: 9/10/84
Date Analyzed: 9/24/84
Conc/Dil Factor: 2 (DIL)

CAS Number		ug/kg
		**********
62-75-9	N-Nitrosodimethylamine	1056 u
108-95-2	Phenol	1056 u
62-53-3	Aniline	1056 u
111-44-4	bis(2-Chloroethyl)Ether	1056 u
95-57-8	2-Chlorophenol	1056 u
541-73-1	1,3-Dichlorobenzene	1056 u
106-46-7	1,4-Dichlorobenzene	1056 u
100-51-6	Benzyl Alcohol	1056 u
95-50-1	1,2-Dichlorobenzene	1056 u
95-48-7	2-Methylphenol	1056 u
39638-32-9	bis(2-chloroisopropyl)Ether	1056 u
106-44-5	4-Methylphenol	1056 u
621-64-7	N-Nitroso-Di-n-Propylamine	1056 u
67-72-1	Hexachloroethane	1056 u
98-95-3	Nitrobenzene	1056 u
78-59-1	Isophorone	1056 u
88-75-5	2-Nitrophenol	1056 u
105-67-9	2,4-Dimethylphenol	1056 u
65-85-0	Benzoic Acid	5120 u
111-91-1	bis(2-Chloroethoxy)Methane	1056 u
120-83-2	2,4-Dichlorophenol	1056 u
120-82-1	1,2,4-Trichlorobenzene	1056 u
91-20-3	Naphthalene	1056 u
106-47-8	4-Chloroaniline	1056 u
87-68-3	Hexachlorobutadiene	1056 u
59-50-7	4-Chloro-3-Methylphenol	1056 u
91-57-6	2-Methylnaphthalene	1056 u
77-47-4	Hexachlorocyclopentadiene	1056 u
88-06-2	2,4,6-Trichlorophenol	1056 u
95-95-4	2,4,5-Trichlorophenol	5120 u
91-58-7	2-Chloronaphthalene	1056 u
88-74-4	2-Nitroaniline	1056 u
131-11-3	Dimethyl Phthalate	1056 u
208-96-8	Acenaphthylene	1056 u
99-09-2	3-Nitroaniline	5120 u

Sample Number
NJ-71-SED-2

Organics Analysis Data Sheet
(Page 4)

Semivolatile Compounds (continued)

Case Number		ug/kg
		**********
83-32-9	Acenaphthene	1056 U
51-28-5	2,4-Dinitrophenol	5400 U
100-02-7	4-Nitrophenol	5120 U
132-64-9	Dibenzofuran	1056 U
121-14-2	2,4-Dinitrotoluene	1056 U
606-20-2	2,6-Dinitrotoluene	1056 U
84-66-2	Diethylphthalate	1056 U
7005-72-3	4-Chlorophenyl-phenylether	1056 U
86-73-7	Fluorene	1000 U
100-01-6	4-Nitroaniline	5120 U
534-52-1	4,6-Dinitro-2-Methylphenol	5100 U
86-30-6	N-Nitrosodiphenylamine(1)	1056 U
101-55-3	4-Bromophenyl-phenylether	1056 U
118-74-1	Hexachlorobenzene	1056 U
87-86-5	Pentachlorophenol	5400 U
85-01-8	Phenanthrene	1056 U
120-12-7	Anthracene	1056 U
84-74-2	Di-n-Butylphthalate	2700 B ✓
206-44-0	Fluoranthene	1056 U
92-87-5	Benzidine	5120 U
129-00-0	Pyrene	1056 U
85-68-7	Butylbenzylphthalate	1056 U
91-94-1	3,3 -Dichlorobenzidine	2112 U
56-55-3	Benzo(a)Anthracene	1056 U
117-81-7	bis(2-Ethylhexyl)Phthalate	1056 U
218-01-9	Chrysene	1056 U
117-84-0	Di-n-Octyl Phthalate	1100 ✓
205-99-2	Benzo(b)Fluoranthene	1056 U
207-08-9	Benzo(k)Fluoranthene	1056 U
50-32-8	Benzo(a)Pyrene	1056 U
193-39-5	Indeno(1,2,3-cd)Pyrene	1056 U
53-70-3	Dibenzo(a,h)Anthracene	1056 U
191-24-2	Benzo(g,h,i)Perylene	1056 U
122-66-7	1,2-Diphenylhydrazine	2112 U

(1)-Cannot be separated from diphenylamine

SAMPLE NUMBER
NJ-71-SED-2

Organics Analysis Data Sheet
(Page 5)

Pesticide/PCBs

Concentration: Low
Date Extracted/Prepared: 9/10/84
Date Analyzed: 10/9/84
Conc/Dil Factor: 50,DIL

CAS Number		ug/kg **********
319-84-6	Alpha-BHC	160.0 u
319-85-7	Beta-BHC	160.0 u
319-86-8	Delta-BHC	160.0 u
58-89-9	Gamma-BHC(lindane)	160.0 u
76-44-8	Heptachlor	160.0 u
309-00-2	Aldrin	160.0 u
1024-57-3	Heptachlor Epoxide	160.0 u
959-98-8	Endosulfan I	160.0 u
60-57-1	Dieldrin	320.0 u
72-55-9	4,4'-DDE	320.0 u
72-20-8	Endrin	320.0 u
33213-65-9	Endosulfan II	320.0 u
72-54-8	4,4'-DDD	320.0 u
7421-93-4	Endrin Aldehyde	320.0 u
1031-07-8	Endosulfan Sulfate	320.0 u
50-29-3	4,4'-DDT	320.0 u
72-43-5	Methoxychlor	1600.0 u
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin	160.0 u
57-74-9	Chlordane	1600.0 u
8001-35-2	Toxaphene	3200.0 u
12674-11-2	Aroclor-1016	1600.0 u
11104-28-2	Aroclor-1221	1600.0 u
11141-16-5	Aroclor-1232	1600.0 u
53469-21-9	Aroclor-1242	1600.0 u
12672-29-6	Aroclor-1248	1600.0 u
11097-69-1	Aroclor-1254	3200.0 u
11096-82-5	Aroclor-1260	3200.0 u

Vi = Volume of extract injected (ul)
Vs = Volume of water extracted (ml)
Ws = Weight of sample extracted (g)
Vt = Volume of total extract (ul)

Vs or Ws 19, Vt 5000 Vi 4

Environmental Protection Agency
CLP Sample Management Office.
P.O.Box 818
Alexandria, Virginia 22313 703/557-2490

Sample Number
NJ-71-SB-1(FIELD BLANK,WATER)

Organics Analysis Data Sheet
(Page 1)

Laboratory Name: NUS CORPORATION
Lab Sample ID No: 14082173 MLS
Sample Matrix: Soil
Data Release Authorized By:

Case No: NJ-71
QC Report No:
Contract No:
Date Sample Received: 8/30/84

****

Volatile Compounds

Concentration: Medium
Date Extracted/Prepared: 9/5/84
Date Analyzed: 9/5/84
Conc/Dil Factor: 1 pH 6
Percent Moisture: NR
Percent Moisture (Decanted): NR

CAS Number		ug/kg	
		**********	
74-87-3	Chloromethane	1000	u
74-83-9	Bromomethane	1000	u
75-01-4	Vinyl chloride	1000	u
75-00-3	Chloroethane	1000	u
75-09-2	Methylene Chloride	4000 B	
67-64-1	Acetone	4900 B	
75-15-0	Carbon Disulfide	500	u
75-35-4	1,1-Dichloroethene	500	u
75-34-3	1,1-Dichloroethane	500	u
156-60-5	Trans-1,2-Dichloroethene	500	u
67-66-3	Chloroform	500	u
107-06-2	1,2-Dichloroethane	500	u
78-93-3	2-Butanone	2100 B	
71-55-6	1,1,1-Trichloroethane	500	u
56-23-5	Carbon Tetrachloride	500	u
108-05-4	Vinyl Acetate	1000	u
75-27-4	Bromodichloromethane	500	u

Data reporting qualifiers are explained on Page 2.
****

Sample Number
NJ-71-SB-1(FIELD BLANK,WATER)

Organics Analysis Data Sheet
(Page 2)

Volatile Compounds (continued)

Case Number		ug/kg
		**********
79-34-5	1,1,2,2-Tetrachloroethane	500 u
78-87-5	1,2-Dichloropropane	500 u
10061-02-6	Trans-1,3-Dichloropropene	500 u
79-01-6	Trichloroethene	500 u
124-48-1	Dibromochloromethane	500 u
79-00-5	1,1,2-Trichloroethane	500 u
71-43-2	Benzene	500 u
10061-01-5	cis-1,3-Dichloropropene	500 u
110-75-8	2-Chloroethylvinylether	1000 u
75-25-2	Bromoform	500 u
591-78-6	2-Hexanone	1000 u
108-10-1	4-Methyl-2-Pentanone	1000 u
127-18-4	Tetrachlorethene	500 u
108-88-3	Toluene	500 u
108-90-7	Chlorobenzene	500 u
100-41-4	Ethylbenzene	500 u
100-42-5	Styrene	500 u
	Total Xylenes	500 u
107-02-8	Acrolein	10000 u
107-13-1	Acrylonitrile	10000 u

Data Reporting Qualifiers

For reporting results to EPA, the following results qualifiers are used. Additional flags or footnotes explaining results are encouraged. However, the definition of each flag must be explained.

Value - If the result is a value greater than or equal to the detection limit, report the value

U - Indicates compound was analyzed for but not detected. Report the minimum detection limit for the sample with the U (e.g. 10U) based on necessary concentration/dilution actions. (This is not necessarily the instrument detection limit.) The footnote should read U - Compound was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

J - Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the indicated detection limit but greater than zero (e.g. 10J).

C - This flag applies to pesticide parameters where the identification has been comfirmed by GC/MS. Single component pesticides)=10ng/ul in the final extract should be confirmed by GC/MS.

B - This flag is used when the analyte is found in the blank as well as a sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

S - Spiked compound.

NR - No value required.

SAMPLE NUMBER
NJ-71-SB-1 (FIELD BLANK,WATER)

Organics Analysis Data Sheet
(Page 3)

Semivolatile Compounds

Concentration: Low
Date Extracted/Prepared: 9/10/84
Date Analyzed: 9/24/84
Conc/Dil Factor: 3 (DIL)

CAS Number		ug/kg
		**********
62-75-9	N-Nitrosodimethylamine	990 u
108-95-2	Phenol	990 u
62-53-3	Aniline	990 u
111-44-4	bis(2-Chloroethyl)Ether	990 u
95-57-8	2-Chlorophenol	990 u
541-73-1	1,3-Dichlorobenzene	990 u
106-46-7	1,4-Dichlorobenzene	990 u
100-51-6	Benzyl Alcohol	990 u
95-50-1	1,2-Dichlorobenzene	990 u
95-48-7	2-Methylphenol	990 u
39638-32-9	bis(2-chloroisopropyl)Ether	990 u
106-44-5	4-Methylphenol	990 u
621-64-7	N-Nitroso-Di-n-Propylamine	990 u
67-72-1	Hexachloroethane	990 u
98-95-3	Nitrobenzene	990 u
78-59-1	Isophorone	990 u
88-75-5	2-Nitrophenol	990 u
105-67-9	2,4-Dimethylphenol	990 u
65-85-0	Benzoic Acid	4800 u
111-91-1	bis(2-Chloroethoxy)Methane	990 u
120-83-2	2,4-Dichlorophenol	990 u
120-82-1	1,2,4-Trichlorobenzene	990 u
91-20-3	Naphthalene	990 u
106-47-8	4-Chloroaniline	990 u
87-68-3	Hexachlorobutadiene	990 u
59-50-7	4-Chloro-3-Methylphenol	990 u
91-57-6	2-Methylnaphthalene	990 u
77-47-4	Hexachlorocyclopentadiene	990 u
88-06-2	2,4,6-Trichlorophenol	990 u
95-95-4	2,4,5-Trichlorophenol	4800 u
91-58-7	2-Chloronaphthalene	990 u
88-74-4	2-Nitroaniline	990 u
131-11-3	Dimethyl Phthalate	990 u
208-96-8	Acenaphthylene	990 u
99-09-2	3-Nitroaniline	4800 u

Sample Number
NJ-71-SB-1 (FIELD BLANK,WATER)

Organics Analysis Data Sheet
(Page 4)

Semivolatile Compounds (continued)

Case Number		ug/kg
		**********
83-32-9	Acenaphthene	~~990~~ U
51-28-5	2,4-Dinitrophenol	~~4000~~ U
100-02-7	4-Nitrophenol	~~4000~~ U
132-64-9	Dibenzofuran	~~990~~ U
121-14-2	2,4-Dinitrotoluene	~~990~~ U
606-20-2	2,6-Dinitrotoluene	~~990~~ U
84-66-2	Diethylphthalate	~~990~~ U
7005-72-3	4-Chlorophenyl-phenylether	~~990~~ U
86-73-7	Fluorene	~~990~~ U
100-01-6	4-Nitroaniline	~~4800~~ U
534-52-1	4,6-Dinitro-2-Methylphenol	~~4000~~ U
86-30-6	N-Nitrosodiphenylamine(1)	~~990~~ U
101-55-3	4-Bromophenyl-phenylether	~~990~~ U
118-74-1	Hexachlorobenzene	~~990~~ U
87-86-5	Pentachlorophenol	~~4000~~ U
85-01-8	Phenanthrene	~~990~~ U
120-12-7	Anthracene	~~990~~ U
84-74-2	Di-n-Butylphthalate	~~4700 B~~ ✓
206-44-0	Fluoranthene	~~990~~ U
92-87-5	Benzidine	~~4000~~ U
129-00-0	Pyrene	~~990~~ U
85-68-7	Butylbenzylphthalate	~~990~~ U
91-94-1	3,3 -Dichlorobenzidine	~~1900~~ U
56-55-3	Benzo(a)Anthracene	~~990~~ U
117-81-7	bis(2-Ethylhexyl)Phthalate	990 U
218-01-9	Chrysene	990 U
117-84-0	Di-n-Octyl Phthalate	990 U
205-99-2	Benzo(b)Fluoranthene	990 U
207-08-9	Benzo(k)Fluoranthene	~~990~~ U
50-32-8	Benzo(a)Pyrene	~~990~~ U
193-39-5	Indeno(1,2,3-cd)Pyrene	990 U
53-70-3	Dibenzo(a,h)Anthracene	990 U
191-24-2	Benzo(g,h,i)Perylene	990 U
122-66-7	1,2-Diphenylhydrazine	1980 U

(1)-Cannot be separated from diphenylamine

SAMPLE NUMBER
NJ-71-SB-1 (FIELD BLANK,WATER)

Organics Analysis Data Sheet
(Page 5)

Pesticide/PCBs

Concentration: Low
Date Extracted/Prepared: 9/10/84
Date Analyzed: 9/25/84
Conc/Dil Factor: 3 (DIL)

CAS Number		ug/kg **********
319-84-6	Alpha-BHC	6.0 u
319-85-7	Beta-BHC	6.0 u
319-86-8	Delta-BHC	6.0 u
58-89-9	Gamma-BHC(lindane)	6.0 u
76-44-8	Heptachlor	6.0 u
309-00-2	Aldrin	6.0 u
1024-57-3	Heptachlor Epoxide	6.0 u
959-98-8	Endosulfan I	6.0 u
60-57-1	Dieldrin	12.0 u
72-55-9	4,4'-DDE	12.0 u
72-20-8	Endrin	12.0 u
33213-65-9	Endosulfan II	12.0 u
72-54-8	4,4'-DDD	12.0 u
7421-93-4	Endrin Aldehyde	12.0 u
1031-07-8	Endosulfan Sulfate	12.0 u
50-29-3	4,4'-DDT	12.0 u
72-43-5	Methoxychlor	60.0 u
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin	6.0 u
57-74-9	Chlordane	60.0 u
8001-35-2	Toxaphene	120.0 u
12674-11-2	Aroclor-1016	60.0 u
11104-28-2	Aroclor-1221	60.0 u
11141-16-5	Aroclor-1232	60.0 u
53469-21-9	Aroclor-1242	60.0 u
12672-29-6	Aroclor-1248	60.0 u
11097-69-1	Aroclor-1254	120.0 u
11096-82-5	Aroclor-1260	120.0 u

Vi = Volume of extract injected (ul)
Vs = Volume of water extracted (ml)
Ws = Weight of sample extracted (g)
Vt = Volume of total extract (ul)

Vs or Ws 10 Vt 5000 Vi 2

Environmental Protection Agency
CLP Sample Management Office.
P.O.Box 818
Alexandria, Virginia 22313 703/557-2490

Sample Number
NJ-71-SW-1

Organics Analysis Data Sheet
(Page 1)

Laboratory Name: NUS CORPORATION
Lab Sample ID No: 14082178
Sample Matrix: Water
Data Release Authorized By:

Case No: NJ-71
QC Report No:
Contract No:
Date Sample Received: 8/30/84

****

Volatile Compounds

Concentration: Low
Date Extracted/Prepared: 9/6/84
Date Analyzed: 9/6/84
Conc/Dil Factor: 1 pH NR
Percent Moisture: NR
Percent Moisture (Decanted): NR

CAS Number		ug/l
		**********
74-87-3	Chloromethane	~~10 U~~
74-83-9	Bromomethane	~~10 U~~
75-01-4	Vinyl chloride	~~10 U~~
75-00-3	Chloroethane	~~10 U~~
75-09-2	Methylene Chloride	~~8.3 B~~ ✓
67-64-1	Acetone	~~89~~ ✓
75-15-0	Carbon Disulfide	~~5 U~~
75-35-4	1,1-Dichloroethene	~~5 U~~
75-34-3	1,1-Dichloroethane	~~5 U~~
156-60-5	Trans-1,2-Dichloroethene	5 U
67-66-3	Chloroform	5 U
107-06-2	1,2-Dichloroethane	5 U
78-93-3	2-Butanone	10 U
71-55-6	1,1,1-Trichloroethane	5 U
56-23-5	Carbon Tetrachloride	5 U
108-05-4	Vinyl Acetate	10 U
75-27-4	Bromodichloromethane	5 U

Data reporting qualifiers are explained on Page 2.
****

Sample Number
NJ-71-SW-1

Organics Analysis Data Sheet
(Page 2)

Volatile Compounds (continued)

Case Number		ug/l
		**********
79-34-5	1,1,2,2-Tetrachloroethane	5 U
78-87-5	1,2-Dichloropropane	5 U
10061-02-6	Trans-1,3-Dichloropropene	5 U
79-01-6	Trichloroethene	5 U
124-48-1	Dibromochloromethane	5 U
79-00-5	1,1,2-Trichloroethane	5 U
71-43-2	Benzene	5 U
10061-01-5	cis-1,3-Dichloropropene	5 U
110-75-8	2-Chloroethylvinylether	10 U
75-25-2	Bromoform	5 U
591-78-6	2-Hexanone	10 U
108-10-1	4-Methyl-2-Pentanone	10 U
127-18-4	Tetrachlorethene	5 U
108-88-3	Toluene	5 J ✓
108-90-7	Chlorobenzene	5 U
100-41-4	Ethylbenzene	5 U
100-42-5	Styrene	5 U
	Total Xylenes	5 U
107-02-8	Acrolein	100 U
107-13-1	Acrylonitrile	100 U

Data Reporting Qualifiers

For reporting results to EPA, the following results qualifiers are used. Additional flags or footnotes explaining results are encouraged. However, the definition of each flag must be explained.

Value - If the result is a value greater than or equal to the detection limit, report the value

U - Indicates compound was analyzed for but not detected. Report the minimum detection limit for the sample with the U (e.g. 10U) based on necessary concentration/dilution actions. (This is not necessarily the instrument detection limit.) The footnote should read U - Compound was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

J - Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the indicated detection limit but greater than zero (e.g. 10J).

C - This flag applies to pesticide parameters where the identification has been comfirmed by GC/MS. Single component pesticides)=10ng/ul in the final extract should be confirmed by GC/MS.

B - This flag is used when the analyte is found in the blank as well a a sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

S - Spiked compound.

NR - No value required.

SAMPLE NUMBER
NJ-71-SW-1

Organics Analysis Data Sheet
(Page 3)

Semivolatile Compounds

Concentration: Low
Date Extracted/Prepared: 9/5/84
Date Analyzed: 9/19/84
Conc/Dil Factor: 1

CAS Number		ug/l
		**********
62-75-9	N-Nitrosodimethylamine	10 u
108-95-2	Phenol	10 u
62-53-3	Aniline	10 u
111-44-4	bis(2-Chloroethyl)Ether	10 u
95-57-8	2-Chlorophenol	10 u
541-73-1	1,3-Dichlorobenzene	10 u
106-46-7	1,4-Dichlorobenzene	10 u
100-51-6	Benzyl Alcohol	10 u
95-50-1	1,2-Dichlorobenzene	10 u
95-48-7	2-Methylphenol	10 u
39638-32-9	bis(2-chloroisopropyl)Ether	10 u
106-44-5	4-Methylphenol	10 u
621-64-7	N-Nitroso-Di-n-Propylamine	10 u
67-72-1	Hexachloroethane	10 u
98-95-3	Nitrobenzene	10 u
78-59-1	Isophorone	10 u
88-75-5	2-Nitrophenol	10 u
105-67-9	2,4-Dimethylphenol	10 u
65-85-0	Benzoic Acid	50 u
111-91-1	bis(2-Chloroethoxy)Methane	10 u
120-83-2	2,4-Dichlorophenol	10 u
120-82-1	1,2,4-Trichlorobenzene	10 u
91-20-3	Naphthalene	10 u
106-47-8	4-Chloroaniline	10 u
87-68-3	Hexachlorobutadiene	10 u
59-50-7	4-Chloro-3-Methylphenol	10 u
91-57-6	2-Methylnaphthalene	10 u
77-47-4	Hexachlorocyclopentadiene	10 u
88-06-2	2,4,6-Trichlorophenol	10 u
95-95-4	2,4,5-Trichlorophenol	50 u
91-58-7	2-Chloronaphthalene	10 u
88-74-4	2-Nitroaniline	50 u
131-11-3	Dimethyl Phthalate	10 u
208-96-8	Acenaphthylene	10 u
99-09-2	3-Nitroaniline	50 u

Sample Number
NJ-71-SW-1

Organics Analysis Data Sheet
(Page 4)

Semivolatile Compounds (continued)

Case Number		ug/l
		**********
83-32-9	Acenaphthene	10 U
51-28-5	2,4-Dinitrophenol	50 U
100-02-7	4-Nitrophenol	50 U
132-64-9	Dibenzofuran	10 U
121-14-2	2,4-Dinitrotoluene	10 U
606-20-2	2,6-Dinitrotoluene	10 U
84-66-2	Diethylphthalate	10 U
7005-72-3	4-Chlorophenyl-phenylether	10 U
86-73-7	Fluorene	20 U
100-01-6	4-Nitroaniline	50 U
534-52-1	4,6-Dinitro-2-Methylphenol	50 U
86-30-6	N-Nitrosodiphenylamine(1)	10 U
101-55-3	4-Bromophenyl-phenylether	10 U
118-74-1	Hexachlorobenzene	10 U
87-86-5	Pentachlorophenol	50 U
85-01-8	Phenanthrene	10 U
120-12-7	Anthracene	10 U
84-74-2	Di-n-Butylphthalate	10 U
206-44-0	Fluoranthene	10 U
92-87-5	Benzidine	50 U
129-00-0	Pyrene	10 U
85-68-7	Butylbenzylphthalate	10 U
91-94-1	3,3 -Dichlorobenzidine	20 U
56-55-3	Benzo(a)Anthracene	10 U
117-81-7	bis(2-Ethylhexyl)Phthalate	10 U
218-01-9	Chrysene	10 U
117-84-0	Di-n-Octyl Phthalate	10 U
205-99-2	Benzo(b)Fluoranthene	10 U
207-08-9	Benzo(k)Fluoranthene	10 U
50-32-8	Benzo(a)Pyrene	10 U
193-39-5	Indeno(1,2,3-cd)Pyrene	10 U
53-70-3	Dibenzo(a,h)Anthracene	10 U
191-24-2	Benzo(g,h,i)Perylene	10 U
122-66-7	1,2-Diphenylhydrazine	20 U

(1)-Cannot be separated from diphenylamine

SAMPLE NUMBER
NJ-71-SW-1

Organics Analysis Data Sheet
(Page 5)

Pesticide/PCBs

Concentration: Low
Date Extracted/Prepared: 9/5/84
Date Analyzed: 9/25/84
Conc/Dil Factor: 1

CAS Number		ug/l **********
319-84-6	Alpha-BHC	0.05 U
319-85-7	Beta-BHC	0.05 U
319-86-8	Delta-BHC	0.05 U
58-89-9	Gamma-BHC(lindane)	0.05 U
76-44-8	Heptachlor	0.05 U
309-00-2	Aldrin	0.05 U
1024-57-3	Heptachlor Epoxide	0.05 U
959-98-8	Endosulfan I	0.05 U
60-57-1	Dieldrin	0.10 U
72-55-9	4,4'-DDE	0.10 U
72-20-8	Endrin	0.10 U
33213-65-9	Endosulfan II	0.10 U
72-54-8	4,4'-DDD	0.10 U
7421-93-4	Endrin Aldehyde	0.10 U
1031-07-8	Endosulfan Sulfate	0.10 U
50-29-3	4,4'-DDT	0.10 U
72-43-5	Methoxychlor	0.50 U
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin	0.05 U
57-74-9	Chlordane	0.50 U
8001-35-2	Toxaphene	1.00 U
12674-11-2	Aroclor-1016	0.50 U
11104-28-2	Aroclor-1221	0.50 U
11141-16-5	Aroclor-1232	0.50 U
53469-21-9	Aroclor-1242	0.50 U
12672-29-6	Aroclor-1248	0.50 U
11097-69-1	Aroclor-1254	1.00 U
11096-82-5	Aroclor-1260	1.00 U

Vi = Volume of extract injected (ul)
Vs = Volume of water extracted (ml)
Ws = Weight of sample extracted (g)
Vt = Volume of total extract (ul)

Vs 1000 or Ws Vt 10000 Vi 2

Environmental Protection Agency
CLP Sample Management Office.
P.O.Box 818
Alexandria, Virginia 22313 703/557-2490

Sample Number
NJ-71-SW-2

Organics Analysis Data Sheet
(Page 1)

Laboratory Name: NUS CORPORATION
Lab Sample ID No: 14082179
Sample Matrix: Water
Data Release Authorized By:

Case No: NJ-71
QC Report No:
Contract No:
Date Sample Received: 8/30/84

Volatile Compounds

Concentration: Low
Date Extracted/Prepared: 9/6/84
Date Analyzed: 9/6/84
Conc/Dil Factor: 1 pH NR
Percent Moisture: NR
Percent Moisture (Decanted): NR

CAS Number		ug/l	
74-87-3	Chloromethane		10 u
74-83-9	Bromomethane		10 u
75-01-4	Vinyl chloride		10 u
75-00-3	Chloroethane		10 u
75-09-2	Methylene Chloride	5 J,B	✓
67-64-1	Acetone	280	✓
75-15-0	Carbon Disulfide		5 u
75-35-4	1,1-Dichloroethene		5 u
75-34-3	1,1-Dichloroethane		5 u
156-60-5	Trans-1,2-Dichloroethene		5 u
67-66-3	Chloroform		5 u
107-06-2	1,2-Dichloroethane		5 u
78-93-3	2-Butanone		10 u
71-55-6	1,1,1-Trichloroethane		5 u
56-23-5	Carbon Tetrachloride		5 u
108-05-4	Vinyl Acetate		10 u
75-27-4	Bromodichloromethane		5 u

Data reporting qualifiers are explained on Page 2.

Sample Number
NJ-71-SW-2

Organics Analysis Data Sheet
(Page 2)

Volatile Compounds (continued)

Case Number		ug/l
		**********
79-34-5	1,1,2,2-Tetrachloroethane	5 U
78-87-5	1,2-Dichloropropane	5 U
10061-02-6	Trans-1,3-Dichloropropene	5 U
79-01-6	Trichloro ethene	5 U
124-48-1	Dibromochloromethane	5 U
79-00-5	1,1,2-Trichloroethane	5 U
71-43-2	Benzene	5 U
10061-01-5	cis-1,3-Dichloropropene	5 U
110-75-8	2-Chloroethylvinylether	10 U
75-25-2	Bromoform	5 U
591-78-6	2-Hexanone	10 U
108-10-1	4-Methyl-2-Pentanone	10 U
127-18-4	Tetrachlorethene	5 U
108-88-3	Toluene	5 U
108-90-7	Chlorobenzene	5 U
100-41-4	Ethylbenzene	5 U
100-42-5	Styrene	5 U
	Total Xylenes	5 U
107-02-8	Acrolein	100 U
107-13-1	Acrylonitrile	100 U

Data Reporting Qualifiers

For reporting results to EPA, the following results qualifiers are used. Additional flags or footnotes explaining results are encouraged. However, the definition of each flag must be explained.

Value - If the result is a value greater than or equal to the detection limit, report the value

U - Indicates compound was analyzed for but not detected. Report the minimum detection limit for the sample with the U (e.g. 10U) based on necessary concentration/dilution actions. (This is not necessarily the instrument detection limit.) The footnote should read U - Compound was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

J - Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the indicated detection limit but greater than zero (e.g. 10J).

C - This flag applies to pesticide parameters where the identification has been comfirmed by GC/MS. Single component pesticides)=10ng/ul in the final extract should be confirmed by GC/MS.

B - This flag is used when the analyte is found in the blank as well a a sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

S - Spiked compound.

NR - No value required.

SAMPLE NUMBER
NJ-71-SW-2

Organics Analysis Data Sheet
(Page 3)

Semivolatile Compounds

Concentration: Low
Date Extracted/Prepared: 9/6,7/84
Date Analyzed: 9/19/84
Conc/Dil Factor: 1

CAS Number		ug/l
		**********
62-75-9	N-Nitrosodimethylamine	10 u
108-95-2	Phenol	10 u
62-53-3	Aniline	10 u
111-44-4	bis(2-Chloroethyl)Ether	10 u
95-57-8	2-Chlorophenol	10 u
541-73-1	1,3-Dichlorobenzene	10 u
106-46-7	1,4-Dichlorobenzene	10 u
100-51-6	Benzyl Alcohol	10 u
95-50-1	1,2-Dichlorobenzene	10 u
95-48-7	2-Methylphenol	10 u
39638-32-9	bis(2-chloroisopropyl)Ether	10 u
106-44-5	4-Methylphenol	10 u
621-64-7	N-Nitroso-Di-n-Propylamine	10 u
67-72-1	Hexachloroethane	10 u
98-95-3	Nitrobenzene	10 u
78-59-1	Isophorone	10 u
88-75-5	2-Nitrophenol	10 u
105-67-9	2,4-Dimethylphenol	10 u
65-85-0	Benzoic Acid	50 u
111-91-1	bis(2-Chloroethoxy)Methane	10 u
120-83-2	2,4-Dichlorophenol	10 u
120-82-1	1,2,4-Trichlorobenzene	10 u
91-20-3	Naphthalene	10 u
106-47-8	4-Chloroaniline	10 u
87-68-3	Hexachlorobutadiene	10 u
59-50-7	4-Chloro-3-Methylphenol	10 u
91-57-6	2-Methylnaphthalene	10 u
77-47-4	Hexachlorocyclopentadiene	10 u
88-06-2	2,4,6-Trichlorophenol	10 u
95-95-4	2,4,5-Trichlorophenol	50 u
91-58-7	2-Chloronaphthalene	10 u
88-74-4	2-Nitroaniline	50 u
131-11-3	Dimethyl Phthalate	10 u
208-96-8	Acenaphthylene	10 u
99-09-2	3-Nitroaniline	50 u

Sample Number
NJ-71-SW-2

Organics Analysis Data Sheet
(Page 4)

Semivolatile Compounds (continued)

Case Number		ug/l
		**********
83-32-9	Acenaphthene	10 U
51-28-5	2,4-Dinitrophenol	50 U
100-02-7	4-Nitrophenol	50 U
132-64-9	Dibenzofuran	10 U
121-14-2	2,4-Dinitrotoluene	10 U
606-20-2	2,6-Dinitrotoluene	10 U
84-66-2	Diethylphthalate	10 U
7005-72-3	4-Chlorophenyl-phenylether	10 U
86-73-7	Fluorene	20 U
100-01-6	4-Nitroaniline	50 U
534-52-1	4,6-Dinitro-2-Methylphenol	50 U
86-30-6	N-Nitrosodiphenylamine(1)	10 U
101-55-3	4-Bromophenyl-phenylether	10 U
118-74-1	Hexachlorobenzene	10 U
87-86-5	Pentachlorophenol	50 U
85-01-8	Phenanthrene	10 U
120-12-7	Anthracene	10 U
84-74-2	Di-n-Butylphthalate	10 U
206-44-0	Fluoranthene	10 U
92-87-5	Benzidine	50 U
129-00-0	Pyrene	10 U
85-68-7	Butylbenzylphthalate	10 U
91-94-1	3,3 -Dichlorobenzidine	20 U
56-55-3	Benzo(a)Anthracene	10 U
117-81-7	bis(2-Ethylhexyl)Phthalate	10 U
218-01-9	Chrysene	10 U
117-84-0	Di-n-Octyl Phthalate	10 U
205-99-2	Benzo(b)Fluoranthene	10 U
207-08-9	Benzo(k)Fluoranthene	10 U
50-32-8	Benzo(a)Pyrene	10 U
193-39-5	Indeno(1,2,3-cd)Pyrene	10 U
53-70-3	Dibenzo(a,h)Anthracene	10 U
191-24-2	Benzo(g,h,i)Perylene	10 U
122-66-7	1,2-Diphenylhydrazine	20 U

(1)-Cannot be separated from diphenylamine

SAMPLE NUMBER
NJ-71-SW-2

Organics Analysis Data Sheet
(Page 5)

Pesticide/PCBs

Concentration: Low
Date Extracted/Prepared: 9/5/84
Date Analyzed: 10/9/84
Conc/Dil Factor: 10

CAS Number		ug/l
		**********
319-84-6	Alpha-BHC	0.50 u
319-85-7	Beta-BHC	0.50 u
319-86-8	Delta-BHC	0.50 u
58-89-9	Gamma-BHC(lindane)	0.50 u
76-44-8	Heptachlor	0.50 u
309-00-2	Aldrin	0.50 u
1024-57-3	Heptachlor Epoxide	0.50 u
959-98-8	Endosulfan I	0.50 u
60-57-1	Dieldrin	1.00 u
72-55-9	4,4 -DDE	1.00 u
72-20-8	Endrin	1.00 u
33213-65-9	Endosulfan II	1.00 u
72-54-8	4,4 -DDD	1.00 u
7421-93-4	Endrin Aldehyde	1.00 u
1031-07-8	Endosulfan Sulfate	1.00 u
50-29-3	4,4 -DDT	1.00 u
72-43-5	Methoxychlor	5.00 u
1746-01-6	2,3,7,8-Tetrachlorodi-benzo-p-dioxin	0.50 u
57-74-9	Chlordane	5.00 u
8001-35-2	Toxaphene	10.00 u
12674-11-2	Aroclor-1016	5.00 u
11104-28-2	Aroclor-1221	5.00 u
11141-16-5	Aroclor-1232	5.00 u
53469-21-9	Aroclor-1242	5.00 u
12672-29-6	Aroclor-1248	5.00 u
11097-69-1	Aroclor-1254	10.00 u
11096-82-5	Aroclor-1260	10.00 u

Vi = Volume of extract injected (ul)
Vs = Volume of water extracted (ml)
Ws = Weight of sample extracted (g)
Vt = Volume of total extract (ul)

Vs 1000 or Ws Vt 10000 Vi 4

Environmental Protection Agency
CLP Sample Management Office.
P.O.Box 818
Alexandria, Virginia 22313 703/557-2490

Sample Number
NJ-71-GW-1

Organics Analysis Data Sheet
(Page 1)

Laboratory Name: NUS CORPORATION
Lab Sample ID No: 14082180
Sample Matrix: Water
Data Release Authorized By:

Case No: NJ-71
QC Report No:
Contract No:
Date Sample Received: 8/30/84

****

Volatile Compounds

Concentration: Low
Date Extracted/Prepared: 9/6/84
Date Analyzed: 9/6/84
Conc/Dil Factor: 1 pH NR
Percent Moisture: NR
Percent Moisture (Decanted): NR

CAS Number		ug/l
		**********
74-87-3	Chloromethane	~~10 u~~
74-83-9	Bromomethane	~~10 u~~
75-01-4	Vinyl chloride	~~10 u~~
75-00-3	Chloroethane	~~10 u~~
75-09-2	Methylene Chloride	~~5 J B~~ ✓
67-64-1	Acetone	~~10 u~~
75-15-0	Carbon Disulfide	~~5 u~~
75-35-4	1,1-Dichloroethene	~~5 u~~
75-34-3	1,1-Dichloroethane	~~5 u~~
156-60-5	Trans-1,2-Dichloroethene	~~5 u~~
67-66-3	Chloroform	5 u
107-06-2	1,2-Dichloroethane	5 u
78-93-3	2-Butanone	~~10 u~~
71-55-6	1,1,1-Trichloroethane	~~5 u~~
56-23-5	Carbon Tetrachloride	5 u
108-05-4	Vinyl Acetate	10 u
75-27-4	Bromodichloromethane	5 u

Data reporting qualifiers are explained on Page 2.
****

Sample Number
NJ-71-GW-1

Organics Analysis Data Sheet
(Page 2)

Volatile Compounds (continued)

Case Number		ug/l
		**********
79-34-5	1,1,2,2-Tetrachloroethane	5 U
78-87-5	1,2-Dichloropropane	[illegible]
10061-02-6	Trans-1,3-Dichloropropene	[illegible]
79-01-6	Trichloroethene	[illegible]
124-48-1	Dibromochloromethane	[illegible]
79-00-5	1,1,2-Trichloroethane	[illegible]
71-43-2	Benzene	[illegible]
10061-01-5	cis-1,3-Dichloropropene	[illegible]
110-75-8	2-Chloroethylvinylether	[illegible]
75-25-2	Bromoform	[illegible]
591-78-6	2-Hexanone	[illegible]
108-10-1	4-Methyl-2-Pentanone	[illegible]
127-18-4	Tetrachlorethene	[illegible]
108-88-3	Toluene	[illegible]
108-90-7	Chlorobenzene	[illegible]
100-41-4	Ethylbenzene	[illegible]
100-42-5	Styrene	[illegible]
	Total Xylenes	[illegible]
107-02-8	Acrolein	[illegible]
107-13-1	Acrylonitrile	[illegible]

Data Reporting Qualifiers

For reporting results to EPA, the following results qualifiers are used. Additional flags or footnotes explaining results are encouraged. However, the definition of each flag must be explained.

Value - If the result is a value greater than or equal to the detection limit, report the value

U - Indicates compound was analyzed for but not detected. Report the minimum detection limit for the sample with the U (e.g. 10U) based on necessary concentration/dilution actions. (This is not necessarily the instrument detection limit.) The footnote should read U - Compound was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

J - Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the indicated detection limit but greater than zero (e.g. 10J).

C - This flag applies to pesticide parameters where the identification has been comfirmed by GC/MS. Single component pesticides)=10ng/ul in the final extract should be confirmed by GC/MS.

B - This flag is used when the analyte is found in the blank as well as a sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

S - Spiked compound.

NR - No value required.

SAMPLE NUMBER
NJ-71-GW-1

Organics Analysis Data Sheet
(Page 3)

Semivolatile Compounds

Concentration: Low
Date Extracted/Prepared: 9/5/84
Date Analyzed: 9/19/84
Conc/Dil Factor: 1

CAS Number		ug/l
		**********
62-75-9	N-Nitrosodimethylamine	10 u
108-95-2	Phenol	10 u
62-53-3	Aniline	10 u
111-44-4	bis(2-Chloroethyl)Ether	10 u
95-57-8	2-Chlorophenol	10 u
541-73-1	1,3-Dichlorobenzene	10 u
106-46-7	1,4-Dichlorobenzene	10 u
100-51-6	Benzyl Alcohol	10 u
95-50-1	1,2-Dichlorobenzene	10 u
95-48-7	2-Methylphenol	10 u
39638-32-9	bis(2-chloroisopropyl)Ether	10 u
106-44-5	4-Methylphenol	10 u
621-64-7	N-Nitroso-Di-n-Propylamine	10 u
67-72-1	Hexachloroethane	10 u
98-95-3	Nitrobenzene	10 u
78-59-1	Isophorone	10 u
88-75-5	2-Nitrophenol	10 u
105-67-9	2,4-Dimethylphenol	50 u
65-85-0	Benzoic Acid	10 u
111-91-1	bis(2-Chloroethoxy)Methane	10 u
120-83-2	2,4-Dichlorophenol	10 u
120-82-1	1,2,4-Trichlorobenzene	10 u
91-20-3	Naphthalene	10 u
106-47-8	4-Chloroaniline	10 u
87-68-3	Hexachlorobutadiene	10 u
59-50-7	4-Chloro-3-Methylphenol	10 u
91-57-6	2-Methylnaphthalene	10 u
77-47-4	Hexachlorocyclopentadiene	10 u
88-06-2	2,4,6-Trichlorophenol	50 u
95-95-4	2,4,5-Trichlorophenol	10 u
91-58-7	2-Chloronaphthalene	50 u
88-74-4	2-Nitroaniline	10 u
131-11-3	Dimethyl Phthalate	10 u
208-96-8	Acenaphthylene	50 u
99-09-2	3-Nitroaniline	

Sample Number
NJ-71-GW-1

Organics Analysis Data Sheet
(Page 4)

Semivolatile Compounds (continued)

Case Number		ug/l
		**********
83-32-9	Acenaphthene	10 u
51-28-5	2,4-Dinitrophenol	50 u
100-02-7	4-Nitrophenol	50 u
132-64-9	Dibenzofuran	10 u
121-14-2	2,4-Dinitrotoluene	10 u
606-20-2	2,6-Dinitrotoluene	10 u
84-66-2	Diethylphthalate	10 u
7005-72-3	4-Chlorophenyl-phenylether	10 u
86-73-7	Fluorene	10 u
100-01-6	4-Nitroaniline	50 u
534-52-1	4,6-Dinitro-2-Methylphenol	50 u
86-30-6	N-Nitrosodiphenylamine(1)	10 u
101-55-3	4-Bromophenyl-phenylether	10 u
118-74-1	Hexachlorobenzene	10 u
87-86-5	Pentachlorophenol	50 u
85-01-8	Phenanthrene	10 u
120-12-7	Anthracene	10 u
84-74-2	Di-n-Butylphthalate	10 u
206-44-0	Fluoranthene	10 u
92-87-5	Benzidine	50 u
129-00-0	Pyrene	10 u
85-68-7	Butylbenzylphthalate	10 u
91-94-1	3,3 -Dichlorobenzidine	20 u
56-55-3	Benzo(a)Anthracene	10 u
117-81-7	bis(2-Ethylhexyl)Phthalate	10 u
218-01-9	Chrysene	10 u
117-84-0	Di-n-Octyl Phthalate	10 u
205-99-2	Benzo(b)Fluoranthene	10 u
207-08-9	Benzo(k)Fluoranthene	10 u
50-32-8	Benzo(a)Pyrene	10 u
193-39-5	Indeno(1,2,3-cd)Pyrene	10 u
53-70-3	Dibenzo(a,h)Anthracene	10 u
191-24-2	Benzo(g,h,i)Perylene	10 u
122-66-7	1,2-Diphenylhydrazine	20 u

(1)-Cannot be separated from diphenylamine

SAMPLE NUMBER
NJ-71-GW-1

Organics Analysis Data Sheet
(Page 5)

Pesticide/PCBs

Concentration: Low
Date Extracted/Prepared: 9/5/84
Date Analyzed: 10/9/84
Conc/Dil Factor: 1

CAS Number		ug/l **********
319-84-6	Alpha-BHC	0.05 u
319-85-7	Beta-BHC	0.05 u
319-86-8	Delta-BHC	0.05 u
58-89-9	Gamma-BHC(lindane)	0.05 u
76-44-8	Heptachlor	0.05 u
309-00-2	Aldrin	0.05 u
1024-57-3	Heptachlor Epoxide	0.05 u
959-98-8	Endosulfan I	0.05 u
60-57-1	Dieldrin	0.10 u
72-55-9	4,4 -DDE	0.10 u
72-20-8	Endrin	0.10 u
33213-65-9	Endosulfan II	0.10 u
72-54-8	4,4 -DDD	0.10 u
7421-93-4	Endrin Aldehyde	0.10 u
1031-07-8	Endosulfan Sulfate	0.10 u
50-29-3	4,4 -DDT	0.10 u
72-43-5	Methoxychlor	0.50 u
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin	0.05 u
57-74-9	Chlordane	0.50 u
8001-35-2	Toxaphene	1.00 u
12674-11-2	Aroclor-1016	0.50 u
11104-28-2	Aroclor-1221	0.50 u
11141-16-5	Aroclor-1232	0.50 u
53469-21-9	Aroclor-1242	0.50 u
12672-29-6	Aroclor-1248	0.50 u
11097-69-1	Aroclor-1254	1.00 u
11096-82-5	Aroclor-1260	1.00 u

Vi = Volume of extract injected (ul)
Vs = Volume of water extracted (ml)
Ws = Weight of sample extracted (g)
Vt = Volume of total extract (ul)

Vs 1000 or Ws Vt 10000 Vi 4

Environmental Protection Agency
CLP Sample Management Office.
P.O.Box 818
Alexandria, Virginia 22313 703/557-2490

Sample Number
NJ-71-GW-2

Organics Analysis Data Sheet
(Page 1)

Laboratory Name: NUS CORPORATION
Lab Sample ID No: 14082181
Sample Matrix: Water
Data Release Authorized By:

Case No: NJ-71
QC Report No:
Contract No:
Date Sample Received: 8/30/84

****

Volatile Compounds

Concentration: Low
Date Extracted/Prepared: 9/6/84
Date Analyzed: 9/6/84
Conc/Dil Factor: 1 pH NR
Percent Moisture: NR
Percent Moisture (Decanted): NR

CAS Number		ug/l	
		**********	
74-87-3	Chloromethane		~~10 u~~
74-83-9	Bromomethane		~~10 u~~
75-01-4	Vinyl chloride		~~10 u~~
75-00-3	Chloroethane		~~10 u~~
75-09-2	Methylene Chloride	~~1 1 B~~	✓
67-64-1	Acetone	330	✓
75-15-0	Carbon Disulfide		~~5 u~~
75-35-4	1,1-Dichloroethene		~~5 u~~
75-34-3	1,1-Dichloroethane		~~5 u~~
156-60-5	Trans-1,2-Dichloroethene		~~5 u~~
67-66-3	Chloroform		~~5 u~~
107-06-2	1,2-Dichloroethane		5 u
78-93-3	2-Butanone		~~10 u~~
71-55-6	1,1,1-Trichloroethane		~~5 u~~
56-23-5	Carbon Tetrachloride		~~5 u~~
108-05-4	Vinyl Acetate		~~10 u~~
75-27-4	Bromodichloromethane		~~5 u~~

Data reporting qualifiers are explained on Page 2.
****

Sample Number
NJ-71-GW-2

Organics Analysis Data Sheet
(Page 2)

Volatile Compounds (continued)

Case Number		ug/l
		**********
79-34-5	1,1,2,2-Tetrachloroethane	5 U
78-87-5	1,2-Dichloropropane	5 U
10061-02-6	Trans-1,3-Dichloropropene	5 U
79-01-6	Trichloroethene	5 U
124-48-1	Dibromochloromethane	5 U
79-00-5	1,1,2-Trichloroethane	5 U
71-43-2	Benzene	5 U
10061-01-5	cis-1,3-Dichloropropene	5 U
110-75-8	2-Chloroethylvinylether	10 U
75-25-2	Bromoform	5 U
591-78-6	2-Hexanone	10 U
108-10-1	4-Methyl-2-Pentanone	10 U
127-18-4	Tetrachlorethene	5 U
108-88-3	Toluene	5 U
108-90-7	Chlorobenzene	5 U
100-41-4	Ethylbenzene	5 U
100-42-5	Styrene	5 U
	Total Xylenes	5 U
107-02-8	Acrolein	100 U
107-13-1	Acrylonitrile	100 U

Data Reporting Qualifiers

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U - Indicates compound was analyzed for but not detected. Report the minimum detection limit for the sample with the U (e.g. 10U) based on necessary concentration/dilution actions. (This is not necessarily the instrument detection limit.) The footnote should read U - Compound was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

J - Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the indicated detection limit but greater than zero (e.g. 10J).

C - This flag applies to pesticide parameters where the identification has been comfirmed by GC/MS. Single component pesticides)=10ng/ul in the final extract should be confirmed by GC/MS.

B - This flag is used when the analyte is found in the blank as well as a sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

S - Spiked compound.

NR - No value required.

SAMPLE NUMBER
NJ-71-GW-2

Organics Analysis Data Sheet
(Page 3)

Semivolatile Compounds

Concentration: Low
Date Extracted/Prepared: 9/5/84
Date Analyzed: 9/19/84
Conc/Dil Factor: 1

CAS Number		ug/l
		**********
62-75-9	N-Nitrosodimethylamine	10 u
108-95-2	Phenol	10 u
62-53-3	Aniline	10 u
111-44-4	bis(2-Chloroethyl)Ether	10 u
95-57-8	2-Chlorophenol	10 u
541-73-1	1,3-Dichlorobenzene	10 u
106-46-7	1,4-Dichlorobenzene	10 u
100-51-6	Benzyl Alcohol	10 u
95-50-1	1,2-Dichlorobenzene	10 u
95-48-7	2-Methylphenol	10 u
39638-32-9	bis(2-chloroisopropyl)Ether	10 u
106-44-5	4-Methylphenol	10 u
621-64-7	N-Nitroso-Di-n-Propylamine	10 u
67-72-1	Hexachloroethane	10 u
98-95-3	Nitrobenzene	10 u
78-59-1	Isophorone	10 u
88-75-5	2-Nitrophenol	10 u
105-67-9	2,4-Dimethylphenol	10 u
65-85-0	Benzoic Acid	50 u
111-91-1	bis(2-Chloroethoxy)Methane	10 u
120-83-2	2,4-Dichlorophenol	10 u
120-82-1	1,2,4-Trichlorobenzene	10 u
91-20-3	Naphthalene	10 u
106-47-8	4-Chloroaniline	10 u
87-68-3	Hexachlorobutadiene	10 u
59-50-7	4-Chloro-3-Methylphenol	10 u
91-57-6	2-Methylnaphthalene	10 u
77-47-4	Hexachlorocyclopentadiene	10 u
88-06-2	2,4,6-Trichlorophenol	10 u
95-95-4	2,4,5-Trichlorophenol	50 u
91-58-7	2-Chloronaphthalene	10 u
88-74-4	2-Nitroaniline	50 u
131-11-3	Dimethyl Phthalate	10 u
208-96-8	Acenaphthylene	10 u
99-09-2	3-Nitroaniline	50 u

Sample Number
NJ-71-GW-2

Organics Analysis Data Sheet
(Page 4)

Semivolatile Compounds (continued)

Case Number		ug/l **********
83-32-9	Acenaphthene	10 u
51-28-5	2,4-Dinitrophenol	50 u
100-02-7	4-Nitrophenol	50 u
132-64-9	Dibenzofuran	10 u
121-14-2	2,4-Dinitrotoluene	10 u
606-20-2	2,6-Dinitrotoluene	10 u
84-66-2	Diethylphthalate	10 u
7005-72-3	4-Chlorophenyl-phenylether	10 u
86-73-7	Fluorene	20 u
100-01-6	4-Nitroaniline	50 u
534-52-1	4,6-Dinitro-2-Methylphenol	50 u
86-30-6	N-Nitrosodiphenylamine(1)	10 u
101-55-3	4-Bromophenyl-phenylether	10 u
118-74-1	Hexachlorobenzene	10 u
87-86-5	Pentachlorophenol	50 u
85-01-8	Phenanthrene	10 u
120-12-7	Anthracene	10 u
84-74-2	Di-n-Butylphthalate	10 u
206-44-0	Fluoranthene	10 u
92-87-5	Benzidine	50 u
129-00-0	Pyrene	10 u
85-68-7	Butylbenzylphthalate	10 u
91-94-1	3,3 -Dichlorobenzidine	20 u
56-55-3	Benzo(a)Anthracene	10 u
117-81-7	bis(2-Ethylhexyl)Phthalate	10 u
218-01-9	Chrysene	10 u
117-84-0	Di-n-Octyl Phthalate	10 u
205-99-2	Benzo(b)Fluoranthene	10 u
207-08-9	Benzo(k)Fluoranthene	10 u
50-32-8	Benzo(a)Pyrene	10 u
193-39-5	Indeno(1,2,3-cd)Pyrene	10 u
53-70-3	Dibenzo(a,h)Anthracene	10 u
191-24-2	Benzo(g,h,i)Perylene	10 u
122-66-7	1,2-Diphenylhydrazine	20 u

(1)-Cannot be separated from diphenylamine

SAMPLE NUMBER
NJ-71-GW-2

Organics Analysis Data Sheet
(Page 5)

Pesticide/PCBs

Concentration: Low
Date Extracted/Prepared: 9/5/84
Date Analyzed: 9/25/84
Conc/Dil Factor: 1

CAS Number		ug/l
		**********
319-84-6	Alpha-BHC	0.05 u
319-85-7	Beta-BHC	0.05 u
319-86-8	Delta-BHC	0.05 u
58-89-9	Gamma-BHC(lindane)	0.05 u
76-44-8	Heptachlor	0.05 u
309-00-2	Aldrin	0.05 u
1024-57-3	Heptachlor Epoxide	0.05 u
959-98-8	Endosulfan I	0.05 u
60-57-1	Dieldrin	0.10 u
72-55-9	4,4 -DDE	0.10 u
72-20-8	Endrin	0.10 u
33213-65-9	Endosulfan II	0.10 u
72-54-8	4,4 -DDD	0.10 u
7421-93-4	Endrin Aldehyde	0.10 u
1031-07-8	Endosulfan Sulfate	0.10 u
50-29-3	4,4 -DDT	0.10 u
72-43-5	Methoxychlor	0.50 u
1746-01-6	2,3,7,8-Tetrachlorodi-benzo-p-dioxin	0.05 u
57-74-9	Chlordane	0.50 u
8001-35-2	Toxaphene	1.00 u
12674-11-2	Aroclor-1016	0.50 u
11104-28-2	Aroclor-1221	0.50 u
11141-16-5	Aroclor-1232	0.50 u
53469-21-9	Aroclor-1242	0.50 u
12672-29-6	Aroclor-1248	0.50 u
11097-69-1	Aroclor-1254	1.00 u
11096-82-5	Aroclor-1260	1.00 u

Vi = Volume of extract injected (ul)
Vs = Volume of water extracted (ml)
Ws = Weight of sample extracted (g)
Vt = Volume of total extract (ul)

Vs 1000 or Ws Vt 10000 Vi 2

Environmental Protection Agency
CLP Sample Management Office.
P.O.Box 818
Alexandria, Virginia 22313 703/557-2490

Sample Number
NJ-71-WB-1

Organics Analysis Data Sheet
(Page 1)

Laboratory Name: NUS CORPORATION
Lab Sample ID No: 14082182
Sample Matrix: Water
Data Release Authorized By:

Case No: NJ-71
QC Report No:
Contract No:
Date Sample Received: 8/30/84

****

Volatile Compounds

Concentration: Low
Date Extracted/Prepared: 9/6/84
Date Analyzed: 9/6/84
Conc/Dil Factor: 1 pH NR
Percent Moisture: NR
Percent Moisture (Decanted): NR

CAS Number		ug/l
		**********
74-87-3	Chloromethane	10 u
74-83-9	Bromomethane	10 u
75-01-4	Vinyl chloride	10 u
75-00-3	Chloroethane	10 u
75-09-2	Methylene Chloride	5 J, B ✓
67-64-1	Acetone	10 u
75-15-0	Carbon Disulfide	5 u
75-35-4	1,1-Dichloroethene	5 u
75-34-3	1,1-Dichloroethane	5 u
156-60-5	Trans-1,2-Dichloroethene	5 u
67-66-3	Chloroform	5 u
107-06-2	1,2-Dichloroethane	5 u
78-93-3	2-Butanone	10 u
71-55-6	1,1,1-Trichloroethane	5 u
56-23-5	Carbon Tetrachloride	5 u
108-05-4	Vinyl Acetate	10 u
75-27-4	Bromodichloromethane	5 u

Data reporting qualifiers are explained on Page 2.
****

Sample Number
NJ-71-WB-1

Organics Analysis Data Sheet
(Page 2)

Volatile Compounds (continued)

Case Number		ug/l
		**********
79-34-5	1,1,2,2-Tetrachloroethane	5 U
78-87-5	1,2-Dichloropropane	5 U
10061-02-6	Trans-1,3-Dichloropropene	5 U
79-01-6	Trichloroethene	5 U
124-48-1	Dibromochloromethane	5 U
79-00-5	1,1,2-Trichloroethane	5 U
71-43-2	Benzene	5 U
10061-01-5	cis-1,3-Dichloropropene	5 U
110-75-8	2-Chloroethylvinylether	10 U
75-25-2	Bromoform	5 U
591-78-6	2-Hexanone	10 U
108-10-1	4-Methyl-2-Pentanone	10 U
127-18-4	Tetrachlorethene	5 U
108-88-3	Toluene	5 U
108-90-7	Chlorobenzene	5 U
100-41-4	Ethylbenzene	5 U
100-42-5	Styrene	5 U
	Total Xylenes	5 U
107-02-8	Acrolein	100 U
107-13-1	Acrylonitrile	100 U

Data Reporting Qualifiers

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C - This flag applies to pesticide parameters where the identification has been comfirmed by GC/MS. Single component pesticides)=10ng/ul in the final extract should be confirmed by GC/MS.

B - This flag is used when the analyte is found in the blank as well as a sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

S - Spiked compound.

NR - No value required.

SAMPLE NUMBER
NJ-71-WB-1

Organics Analysis Data Sheet
(Page 3)

Semivolatile Compounds

Concentration: Low
Date Extracted/Prepared: 9/5/84
Date Analyzed: 9/19/84
Conc/Dil Factor: 1

CAS Number		ug/l **********
62-75-9	N-Nitrosodimethylamine	10 u
108-95-2	Phenol	10 u
62-53-3	Aniline	10 u
111-44-4	bis(2-Chloroethyl)Ether	10 u
95-57-8	2-Chlorophenol	10 u
541-73-1	1,3-Dichlorobenzene	10 u
106-46-7	1,4-Dichlorobenzene	10 u
100-51-6	Benzyl Alcohol	10 u
95-50-1	1,2-Dichlorobenzene	10 u
95-48-7	2-Methylphenol	10 u
39638-32-9	bis(2-chloroisopropyl)Ether	10 u
106-44-5	4-Methylphenol	10 u
621-64-7	N-Nitroso-Di-n-Propylamine	10 u
67-72-1	Hexachloroethane	10 u
98-95-3	Nitrobenzene	10 u
78-59-1	Isophorone	10 u
88-75-5	2-Nitrophenol	10 u
105-67-9	2,4-Dimethylphenol	10 u
65-85-0	Benzoic Acid	50 u
111-91-1	bis(2-Chloroethoxy)Methane	10 u
120-83-2	2,4-Dichlorophenol	10 u
120-82-1	1,2,4-Trichlorobenzene	10 u
91-20-3	Naphthalene	10 u
106-47-8	4-Chloroaniline	10 u
87-68-3	Hexachlorobutadiene	10 u
59-50-7	4-Chloro-3-Methylphenol	10 u
91-57-6	2-Methylnaphthalene	10 u
77-47-4	Hexachlorocyclopentadiene	10 u
88-06-2	2,4,6-Trichlorophenol	10 u
95-95-4	2,4,5-Trichlorophenol	50 u
91-58-7	2-Chloronaphthalene	10 u
88-74-4	2-Nitroaniline	50 u
131-11-3	Dimethyl Phthalate	10 u
208-96-8	Acenaphthylene	10 u
99-09-2	3-Nitroaniline	50 u

Sample Number
NJ-71-WB-1

Organics Analysis Data Sheet
(Page 4)

Semivolatile Compounds (continued)

Case Number		ug/l **********
83-32-9	Acenaphthene	10 U
51-28-5	2,4-Dinitrophenol	50 U
100-02-7	4-Nitrophenol	50 U
132-64-9	Dibenzofuran	10 U
121-14-2	2,4-Dinitrotoluene	10 U
606-20-2	2,6-Dinitrotoluene	10 U
84-66-2	Diethylphthalate	10 U
7005-72-3	4-Chlorophenyl-phenylether	10 U
86-73-7	Fluorene	10 U
100-01-6	4-Nitroaniline	50 U
534-52-1	4,6-Dinitro-2-Methylphenol	50 U
86-30-6	N-Nitrosodiphenylamine(1)	10 U
101-55-3	4-Bromophenyl-phenylether	10 U
118-74-1	Hexachlorobenzene	10 U
87-86-5	Pentachlorophenol	50 U
85-01-8	Phenanthrene	10 U
120-12-7	Anthracene	10 U
84-74-2	Di-n-Butylphthalate	10 U
206-44-0	Fluoranthene	10 U
92-87-5	Benzidine	50 U
129-00-0	Pyrene	10 U
85-68-7	Butylbenzylphthalate	10 U
91-94-1	3,3 -Dichlorobenzidine	20 U
56-55-3	Benzo(a)Anthracene	10 U
117-81-7	bis(2-Ethylhexyl)Phthalate	10 J
218-01-9	Chrysene	10 U
117-84-0	Di-n-Octyl Phthalate	10 U
205-99-2	Benzo(b)Fluoranthene	10 U
207-08-9	Benzo(k)Fluoranthene	10 U
50-32-8	Benzo(a)Pyrene	10 U
193-39-5	Indeno(1,2,3-cd)Pyrene	10 U
53-70-3	Dibenzo(a,h)Anthracene	10 U
191-24-2	Benzo(g,h,i)Perylene	10 U
122-66-7	1,2-Diphenylhydrazine	20 U

(1)-Cannot be separated from diphenylamine

SAMPLE NUMBER
NJ-71-WB-1

Organics Analysis Data Sheet
(Page 5)

Pesticide/PCBs

Concentration: Low
Date Extracted/Prepared: 9/5/84
Date Analyzed: 9/25/84
Conc/Dil Factor: 1

CAS Number		ug/l **********
319-84-6	Alpha-BHC	0.05 U
319-85-7	Beta-BHC	0.05 U
319-86-8	Delta-BHC	0.05 U
58-89-9	Gamma-BHC(lindane)	0.05 U
76-44-8	Heptachlor	0.05 U
309-00-2	Aldrin	0.05 U
1024-57-3	Heptachlor Epoxide	0.05 U
959-98-8	Endosulfan I	0.05 U
60-57-1	Dieldrin	0.10 U
72-55-9	4,4'-DDE	0.10 U
72-20-8	Endrin	0.10 U
33213-65-9	Endosulfan II	0.10 U
72-54-8	4,4'-DDD	0.10 U
7421-93-4	Endrin Aldehyde	0.10 U
1031-07-8	Endosulfan Sulfate	0.10 U
50-29-3	4,4'-DDT	0.10 U
72-43-5	Methoxychlor	0.50 U
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin	0.05 U
57-74-9	Chlordane	0.50 U
8001-35-2	Toxaphene	1.00 U
12674-11-2	Aroclor-1016	0.50 U
11104-28-2	Aroclor-1221	0.50 U
11141-16-5	Aroclor-1232	0.50 U
53469-21-9	Aroclor-1242	0.50 U
12672-29-6	Aroclor-1248	0.50 U
11097-69-1	Aroclor-1254	1.00 U
11096-82-5	Aroclor-1260	1.00 U

Vi = Volume of extract injected (ul)
Vs = Volume of water extracted (ml)
Ws = Weight of sample extracted (g)
Vt = Volume of total extract (ul)

Vs 1000 or Ws Vt 10000 Vi 2

REFERENCE #18

SOIL CHEMISTRY

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A WILEY-INTERSCIENCE
PUBLICATION

JOHN WILEY & SONS

New York Chichester
Brisbane Toronto

The other alkali and alkaline earth cations are present in soils only in trace amounts. Their ranges of total soil content are approximately: Li, 10 to 300 ppm; Rb, 20 to 500 ppm; Be, 0.5 to 10 ppm; Sr, 600 to 1000 ppm; Ba, 100 to 3000 ppm; and Ra, perhaps 10^{-7} ppm. Some varieties of tree fruits are sensitive to as little as 1 ppm Li^+ in irrigation water, but Li^+ toxicity is exceedingly rare. Rubidium, Cs, Sr, and Ba have all been studied in the laboratory but have received little attention in the field. The radioactive isotope ^{90}Sr (half-life = 28 years) has been studied because of the possibility of long-term soil contamination after nuclear explosions. In soils the toxic Be^{2+} ion (Section 10.4) behaves more like Al^{3+} than alkaline earth cations.

Excluding specific adsorption of K^+, NH_4^+, and Mg^{2+} by some soil minerals (Section 5.4), the strength of adsorption of cations generally increases with increasing ion charge and with decreasing hydrated ion size (increasing dehydrated cation size, Section 2.2.1). For monovalent cations the order of retention is

$$Li < Na < NH_4 \approx K < Rb < Cs < Tl < Ag < H^+(Al^{3+})$$

Only Na, NH_4, K, and H are of significance in natural soils. The order of soil retention for the divalent cations is

$$Mg < Ca < Sr < Ba$$

Only Mg^{2+} and Ca^{2+} are common in soils, and Ca^{2+} dominates the exchange complex of most soils.

Small amounts of transition metal and aluminum ions are also removed by neutral salt solutions. The amount increases with acidity, but the degree of exchangeability is difficult to define, because it depends strongly on the nature of the extracting solution (Chapter 7). The approximate order of trivalent cation retention is:

$$Al < Fe < Sc < Y < Eu < Sm < Nd < Pr < Ce < La$$

Only Al^{3+} is a common exchangeable cation in soils and then only in moderately to strongly acid soils, pH < 5.5.

Various cation exchange equations have been proposed to define the distribution of cations between the exchanger and solution phases (Chapters 5 and 8). These equations have had a mixed reception from soil scientists, often because each equation has a different range of applicability. Most applications of such equations have been to salt-affected soils. The ex-

TABLE 10.5

Total Contents of Transition and Related Metal Ions in the Lithosphere and in Soils[a]

ELEMENT	AVERAGE OF LITHOSPHERE (ppm)	TYPICAL RANGE IN SOILS (ppm)
Be	6	3–40
Ti	4400	1,000–10,000
V	150	20–500
Cr	200	5–1,000
Mn	1000	200–2,000
Fe	50,000	50,000–300,000
Co	40	1–70
Ni	100	10–1,000
Cu	70	2–100
Zn	80	10–300
Y	30	3–80
Zr	220	60–2,000
Mo	2	0.2–5
Cd	—	0.01–7
Sn	40	<5
Lanthanides, total	—	10–500
Hg	—	0.02–0.2
Pb	11	2–200

[a] After D. J. Swaine, Commonwealth Bur. Soil Sci. Tech. Communications 48, Farnham Royal, Bucks., England, 1955, and W. H. Fuller, EPA-600/2-77-020, 1977.

products. This suggests that the ions are retained by soils much more strongly than as pure hydroxyoxides. The relative soil retention of these cations, however, roughly follows the order of decreasing (more negative) solubility products of the oxidized cations. Reducing conditions increase the Fe^{2+} and Mn^{2+} concentrations and complexing by soluble organic ligands can somewhat increase the concentration of Cu^{2+} and perhaps Zn^{2+}.

Because these cations are multivalent, their hydroxyoxide ion products involve the second, third, or fourth power of the OH^- activity. Their concentration changes in soil solutions, however, tend to be proportional to only the first power of (OH^-) or (H^+). This is partly explainable by hydrolysis. The mechanism of iron(III) dissolution and precipitation at the pH of normal soils, for example, is probably

$$FeOOH + H^+ = Fe(OH)_2^+ \qquad (10.4)$$

Hence only 1 mole of H^+ is required to dissolve 1 mole of FeOOOH.

The amount in the solid phase is a poor indicator of the ion's availability to plants. Defining the amounts toxic to plants, or animals subsisting on those plants, is very difficult (Section 1.3). Plant concentrations indicative of toxicity are unknown for most plants and vary with growth conditions. The soil solution column of Table 10.6 gives estimates of the ion concentrations that are immediately available to plants. Recommended maxima for livestock drinking water in Table 10.7 might serve as very conservative guides to desirable maxima in soil solutions. Plants are much more tolerant of high trace metal concentrations than are animals. Soil retention, exclusion by plant roots, and limited translocation to the plant top, all exclude trace metal ions from the animal food chain. Plants had to evolve a greater range of tolerance because they are limited to the soil volume within reach of their roots.

Soil solution concentrations of most trace metals are largely unknown because of difficulties in measurement. Values in Table 10.6 marked with [b] are only rough estimates derived from the composition of seawater. Reported Mn and Cu concentrations in soil solutions are about 30 times

TABLE 10.6

Natural Soil and Plant Concentrations of Elements That Have Been Implicated as Being Toxic[a]

	TOTAL SOIL		SOIL SOLUTION	PLANTS
ELEMENT	TYPICAL VALUE (ppm)	RANGE (ppm)	mg/l	RANGE (ppm)
Cadmium	0.06	0.01-7	0.001[b]	0.2-0.8
Cobalt	8	1-40	0.01[b]	0.05-0.5
Copper	20	2-100	0.03-0.3	4-15
Lead	10	2-200	0.001[b]	0.1-10
Manganese	850	100-4000	0.1-10	15-100
Nickel	40	10-1000	0.05[b]	~1
Zinc	50	10-300	<0.005	8-15
Arsenic	5	1-50	0.1[b]	—
Beryllium	1	0.2-10	0.001[b]	—
Chromium	20	5-1000	0.001[b]	—
Selenium	0.5	0.1-2.0	0.001-0.01	—
Mercury	0.05	0.02-0.2	0.001	—

[a] From W. H. Allaway, *Advan. Agron.* 20:235, 1968, and R. P. Murrman and F. R. Koutz, Spec. Report No. 171, U.S. Army Cold Regions Res. and Engin. Lab. Hanover, New Hampshire, 1972.

[b] Estimated as 30× its concentration in seawater.

for livestock

ION
Aluminum
Arsenic
Beryllium
Boron
Cadmium
Chromium
Cobalt
Copper
Fluoride
Iron
Lead
Manganese
Mercury
Molybden
Nitrate +
Nitrite
Selenium
Vanadium
Zinc
Total Diss

[a] From *Water* Sci., Nat. Ac

[b] Lead is acc mg/l.

greater than con other ions as well.

All of the micr are toxic at soil high concentratic spread Al^{3+} phyt toxic elements is genic pollutant order of atomi Cr(III-VI), Ni Pb(II-IV). Soil wastes, pesticid of these ions to